



United States
Department of
Agriculture

Forest
Service

May 2002



Environmental Assessment

East Clear Creek Watershed Health Project

Mogollon Rim Ranger District, Coconino National Forest
Coconino County, Arizona

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Table of Contents

CHAPTER 1 PURPOSE AND NEED	1
Project Scope	1
Relationship to the Forest Plan and Other Relevant Planning Documents.....	1
Background	2
Purpose And Need For Action	3
Proposed Action	8
Project Area	10
Objectives and Measures	10
Decision To Be Made	11
Public Involvement.....	11
Issues	12
Applicable Laws And Executive Orders	12
Permits, Licenses, And Certificates	13
US Army Corps of Engineers	13
State of Arizona, Department of Environmental Quality	13
Applicable Legal And Regulatory Requirements And Coordination.....	13
Legal Requirements	13
Regulatory Requirements	13
Coordination Requirements	13
Project Record Availability	13
CHAPTER 2 ALTERNATIVES	15
Alternatives Considered But Eliminated From Detailed Study	15
Alternatives.....	16
Alternative A (No Action)	16
Alternative B (Proposed Action).....	16
Soils and Vegetation	16
Water Quality, Water Quantity, and Water Rights	17
Alternative C (Preferred Alternative)	17
Alternative Mitigation	21
Preferred Alternative Identification.....	21
CHAPTER 3 AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES	30
Analyzing Effects	30
Direct, Indirect and Cumulative Effects.....	30
Unavoidable Adverse Effects.....	31
Short-term Use and Long-term Productivity.....	31
Irreversible and Irretrievable Commitments	31
Available Information	31
Plans of Other Agencies	32
Environmental Effects And The Significant Issues	32
Affected Environment.....	32
Effects of Alternative A.....	33
Effects of Alternative B and C	33
Cumulative Effects	33
Environment And Effects Of Other Resources	33
Effects to Soil Resources.....	33

Chapter 1 Purpose and Need
East Clear Creek Watershed Health Environmental Assessment

Affected Environment.....	33
Effects of Alternative A.....	35
Effects of Alternative B and C	35
Cumulative Effects	35
Effects to Wildlife	36
Affected Environment.....	36
Management Indicator Species	39
Federally Endangered Species.....	41
Federally Threatened Species.....	41
Federally Proposed Species.....	43
Sensitive Species	43
The Effects of Alternative A on Wildlife	47
Effects Of Alternatives B And C On Wildlife	48
Cumulative Effects	54
Recreation and Visual Quality	70
Affected Environment.....	70
Effects of Alternative A.....	72
Effects of Alternatives B and C.....	72
Cumulative Effects	73
Cultural Resources	73
Affected Environment.....	73
Effects of Alternative A.....	73
Effects of Alternatives B and C.....	74
Cumulative Effects	74
Water Quality.....	74
Affected Environment.....	74
Effects of Alternative A.....	75
Effects of Alternative B and C	75
Cumulative Effects	76
Vegetation	76
Affected Environment.....	76
Effects of Alternative A.....	77
Effects of Alternative B and C	77
Cumulative Effects	79
Air	79
Affected Environment.....	79
Effects of Alternative A.....	80
Effects of Alternative B and C	80
Cumulative Effects	80
Economics	80
Affected Environment.....	80
Effects of Alternative A.....	81
Effects of Alternative B and C	81
Environmental Justice.....	82
Description Of Relevant Past, Present, And Foreseeable Future Actions Not Part Of The Analysis	83

Chapter 1 Purpose and Need
East Clear Creek Watershed Health Environmental Assessment

Past Actions	83
Present Actions	83
Reasonably Foreseeable Future Actions	83
Predicted Attainment of Project Objectives.....	83
Predicted Attainment of Objective #1	83
Predicted Attainment of Objective #2	86
Predicted Attainment of Objective #3	86
Predicted Attainment of Objective #4	88
Predicted Attainment of Objective #5	88
Predicted Attainment of Objective #6	89
Predicted Attainment of Objective #7	90
CHAPTER 4 MONITORING	91
Required Monitoring	91
Cultural Resources.....	91
Wildlife/Aquatic Resources	91
Soil and Water.....	91
CHAPTER 5 LIST OF PREPARERS.....	92
CHAPTER 6 LIST OF AGENCIES, ORGANIZATIONS, AND PERSONS CONSULTED AND/OR PROVIDED COPIES OF THIS ENVIRONMENTAL ASSESSMENT	93
CHAPTER 7 APPENDICES	98
CHAPTER 8 REFERENCES.....	112

CHAPTER 1 PURPOSE AND NEED

The Forest Service has prepared this Environmental Assessment in compliance with the National Environmental Policy Act (NEPA) and other relevant federal and state laws and regulations. This Environmental Assessment discloses the direct, indirect, and cumulative environmental impacts that would result from the proposed action and alternatives.

This chapter describes the following:

- Project Scope
- Background
- Purpose and Need for Action
- Proposed Action
- Objectives and Measures
- Decision To Be Made
- Public Involvement
- Issues
- Applicable Laws and Executive Orders
- Permits, Licenses and Certifications
- Additional NEPA Analyses Being Undertaken
- Project Record Availability

Project Scope

This report summarizes the site-specific planning process and the environmental, social, and economic impacts of three alternatives for improving watershed health. This Environmental Assessment (EA) is not a decision document. The EA discloses the purpose and need for action, environmental consequences of implementing the proposed action and alternatives to the proposed action. The District Ranger's decision will be stated and explained in a Decision Notice when the planning process is completed. The Project Record documenting the process and analysis includes all resource specialists' data and reports. The process record is located at the Mogollon Rim Ranger District Office.

Relationship to the Forest Plan and Other Relevant Planning Documents

National Forest planning takes place at several levels: national, regional, forest, and project levels. The East Clear Creek Watershed Health EA is a project-level analysis; its scope is confined to addressing the significant issues and possible environmental consequences of the project. It does not attempt to address decisions made at higher levels. It does, however, implement direction provided at those higher levels.

The Coconino National Forest Plan (USDA 1987) embodies the provisions of the National Forest Management Act (1976), its implementing regulations, and other

guiding documents. The Forest Plan sets forth in detail the direction for managing the land and resources of the Coconino National Forest. Where appropriate, the East Clear Creek Watershed Health EA tiers to the Coconino Forest Plan FEIS (USDA 1987), 40 CFR 1502.20.

There are four relevant planning documents that are germane to the analysis. The first document is the Coconino National Forest Land and Resource Management Plan (Forest Plan) that contains standards and guidelines for management of all resources on the Coconino National Forest (USDA 1987).

The second relevant planning document is the *East Clear Creek Watershed Recovery Strategy for the Little Colorado Spinedace and Other Riparian Species*. This document gives an overall strategy for improving riparian habitats throughout the watershed and outlines a broad variety of possible management actions that would improve riparian conditions within the entire watershed. The document has subsequently resulted in a Memorandum of Understanding (MOU) among the Coconino National Forest, the Apache-Sitgreaves National Forest, the Arizona Game and Fish Department and the US Fish and Wildlife Service to use this document as guidance in recovery of the Little Colorado Spinedace (USDA 1999).

The third planning document is the Recovery Plan for the Little Colorado spinedace (USDI 1999). This is a guidance document to move towards recovery of the Little Colorado spinedace, a threatened species under the Endangered Species Act. Many of the actions in this plan are included in the *East Clear Creek Watershed Recovery Strategy for the Little Colorado Spinedace and Other Riparian Species* document.

The fourth relevant planning document is the Ecosystem Assessment of the East Clear Creek (ECC) Watershed (USDA 1996). This is an overview guidance document that complies with National Forest Management Act requirements for the entire East Clear Creek watershed that describes the existing conditions, desired conditions, and possible management practices.

Background

The Proposed Action for watershed health actions was originally scoped under the Buck Springs Range Allotment Environmental Impact statement along with range management actions. The sheer complexity of the analysis as well as the desire to be able to discuss alternatives and actions clearly prompted the ID team to request to the District Ranger that there be two separate Environmental Assessments (EA's) from the original Proposed Action—a solely range management NEPA process, and a watershed health NEPA process. The action to create two separate NEPA documents was approved by District Ranger Larry Sears in May of 2000 [65]¹. This EA will pertain to the watershed health actions. The original analysis area was further modified to delete the Victorine Analysis Area that is in the northeast corner of the area when the Victorine

¹ Source documents from the project record are referenced throughout this EA by showing the document number in brackets [#].

area analysis was initiated in 1999 [69]. The separation of the documents has been done to: 1) make sure the discussion of proposed actions and their effects are as clear as possible, and 2) to simplify an extremely complex analysis.

The East Clear Creek (ECC) watershed has received much scrutiny in recent years. In 1995, a collaborative group comprised of state and federal agencies, local residents, interested people, and tribal representatives initiated an Ecosystem Assessment of the East Clear Creek (ECC) Watershed, which includes 96% of the Buck Springs Range Allotment within its boundaries. The Collaborative Team described existing and desired future functioning conditions of the watershed, and developed lists of possible management practices to take the watershed towards desired conditions. The work of the Collaborative Team was taken forward into the analysis of the allotment.

Acting Blue Ridge District Ranger, Erin Connelly, formally initiated the environmental analysis process for the Buck Springs Range Allotment with a project initiation letter dated June 25, 1998 [2]. An Interdisciplinary Team (Team) of Forest Service resource specialists, and representatives from the Arizona Game and Fish Department (AGFD), US Fish and Wildlife Service (USFWS), Arizona Department of Environmental Quality (ADEQ), and the Allotment Permittee developed a guiding document for watershed recovery before undertaking an analysis of the allotment. They discovered that many factors affect watershed conditions within the allotment, including elk and livestock grazing, recreation, transportation system, and introduced aquatic species. (USDA 1999). In an cooperative effort, the agencies making up the Team developed the *East Clear Creek Watershed Recovery Strategy for the Little Colorado Spinedace and Other Riparian Species* (ECC Strategy) to address many of those factors. Using the document to guide actions proposed for the East Clear Creek Watershed Health project, the Team expanded on existing and desired conditions developed by the ECC Collaborative Team and developed objectives and proposed management practices for the allotment. These practices included actions specific to the range permit, as well as actions to assist in recovering the watershed.

Purpose And Need For Action

During the East Clear Creek Collaborative Team effort, as well as during the development of the *East Clear Creek Watershed Recovery Strategy for the Little Colorado Spinedace and Other Riparian Species* (USDA 1999), Forest Service and publics identified existing and desired conditions for the East Clear Creek watershed (USDA 1996, USDA 1999) [34, 35]. Within the East Clear Creek Watershed Health project portion of the watershed, there were several disconnects between the existing condition and the desired conditions. This disconnects between the desired conditions and the existing conditions are the purpose and need for the action. Table 1 below summarizes the desired and existing conditions for the analysis area.

Change in Soil and Watershed Condition Meadow condition surveys in 1995 display that meadow soil condition is unsatisfactory [22]. Unsatisfactory soil condition exists in a majority of meadows due to soil compaction. These in turn results in a loss of organic

matter in the soil surface A horizon within the dominant plant community, namely the Poa dominated grass community. A reduction of pore space, the closing of soil pores and the development of platy or massive soil structure in the surface horizon severely limits water infiltration and increases overland flow. This condition is primarily the result of historic and present excessive ungulate grazing, with contributions by roads and dispersed recreation activities such as vehicle use and camping. Exceptions to this condition are found in total ungulate exclosure areas within Buck Springs, Merritt and Houston Draws, where soil conditions are satisfactory on approximately 12 acres.

As a result, increased runoff has contributed toward the establishment of gully erosion, especially within the meadow systems. Vertical banks and head cuts provide evidence that the volume of water associated with peak flows is greater than these stream channels experienced (Haines, 1993). The area of wetted riparian areas has decreased with the gulying associated with the denuded headwater meadow systems. Headwater meadows are in unsatisfactory conditions and shallow drainage riparian areas are nonfunctional, reducing base flows and affecting habitats (decrease in plant biodiversity and structural diversity) that support aquatic dependent and associated species, such as the Little Colorado spinedace and leopard frogs. Compacted soils and poorly located and maintained roads contribute to excessive runoff in the form of increased water volumes and higher peak flows in stream channels. The result is gulying which indicates a system of unstable stream channels. Proper functioning condition assessments of riparian areas were completed in 1995, 1998, and 1999 and documented that the meadow riparian areas were nonfunctional [22].

Tanks located in meadows contribute to increased use by ungulates. Permanent waters can result in denuded sacrifice areas around watering points (Stoddart et al, 1975) but can also be used to improve utilization across a grazed area. Within the analysis area, tanks in Barbershop Canyon, as well as Ronny's Tank, Kinder Tank, and Goddard Tank (on private land) are located within the Kinder meadow complex, drawing ungulates into the meadows. The tanks also disturb natural stream flows through the meadow systems.

Change in fire regime and fuel loadings The natural fire regime has been altered through fire exclusion over the past half century. This has resulted in higher fuel loadings and an increase in the number of trees per acre throughout the entire watershed. The high fuel loadings are a threat to current watershed conditions within the analysis area through the increased potential for large stand-replacing fires within the analysis area.

Table 1 Summary of Existing and Desired Conditions for the East Clear Creek Watershed Health Analysis Area

Existing Conditions	Desired Conditions/Management Direction
<p>Meadow conditions are unsatisfactory resulting in degraded riparian conditions and gully systems in meadows. Kentucky bluegrass, a shallow-rooted, non-native species, dominates meadows. Kentucky bluegrass does not withstand high-flow events well and is not a bank stabilizer.</p>	<ul style="list-style-type: none"> • Maintain current satisfactory watershed conditions and improve any unsatisfactory conditions to satisfactory by the year 2020 (FLMP² p. 74). • Plan and design projects in areas of unsatisfactory or degraded condition to promote channel and streambank stability and to improve the flow and timing of water (FLMP p73). • Maintain existing mountain meadows by removing invading overstory by cutting or other methods, gully stabilization to raise water table, soil scarification, and seeding with appropriate grass and forage species (FLMP Amendment 10, replacement page 160). • Meet Riparian Standards in the Regional Guide for 80 percent of riparian areas above the Rim...by the year 2030 (FLMP Amendment 2, replacement page 174). • Through coordination with other disciplines, maintain or improve, where necessary, riparian vegetation along streams for moderating water temperature and protecting bank stability (FLMP p177). • Our vision is of riparian areas and meadows that are in proper functioning condition with satisfactory soils, so that the result provides the type of ecosystem that will support flora and fauna typical of riparian and wetland meadows (ECC EM project DFC³). • Riparian vegetation has a diverse age-class distribution, a diverse composition, and includes species that indicate maintenance of riparian soil moisture characteristics. Streambank vegetation is comprised of plant communities that have root masses capable of withstanding high streamflow events, and has adequate cover to protect banks and dissipate energy during high flows. Riparian plants exhibit high vigor, resist compaction, and where soils are appropriate, provide an adequate source of coarse and/or large woody debris (ECC EM project DFC).
<p>Degraded riparian conditions are resulting in degraded habitat for Threatened and Endangered (T & E) species, especially the Little Colorado spinedace</p>	<ul style="list-style-type: none"> • Improve T&E and sensitive species habitat. Improvement projects give priority to recovery of the T&E species. Conform to approved recovery plans (FLMP Amendment 11, replacement page 66).

² FLMP—Coconino National Forest Land and Management Plan (USDA 1987)

³ ECC EM project DFC—East Clear Creek Ecosystem Management Project Desired Future Condition (USDA 1996). Please refer to page 2, chapter 1 in the section entitled Relationship to the Forest Plan and Other Relevant Planning Documents for a discussion of this planning document.

Table 1 (continued)

Existing Conditions	Desired Conditions/Management Direction
<p>Roads throughout the watershed are impacting water quality and timing of flows, thus impacting meadows and T & E species habitat</p>	<ul style="list-style-type: none"> • Coordinate trail management, use, and development with other resource management considerations (FLMP p55). • Roads that exist create minimum effects to meadow and riparian function (ECC EM project DFC). • Meadows and riparian areas are visually attractive and free from evidence of physical, mechanical, or vegetative damage due to recreation activities. Physical impacts to meadows and riparian areas shall be confined to specified road crossings, trail crossings and access points. These structures are designed to minimize damage to meadows and riparian area (ECC EM project DFC). • Manage dispersed recreation sites for public safety, resource protection, compliance checks, and capacity monitoring...Areas damaged due to use are closed and restored as necessary. • The following criteria are used to evaluate the need for future closures to vehicles <ol style="list-style-type: none"> 1. Riparian areas being threatened or damaged 2. Meadows likely to be or being damaged 3. Habitat for threatened, endangered, or sensitive that is threatened (FLMP p 58-59).
<p>Fuel loadings (both live and dead) have increased over time due to a change in fire regime through fire suppression. The result is an increased threat of large stand-replacing fires that are increasing the risk to watershed condition and T&E species habitat</p>	<ul style="list-style-type: none"> • Maintain current satisfactory watershed conditions and improve any unsatisfactory conditions to satisfactory by the year 2020 (FLMP p. 74) • Improve T&E and sensitive species habitat. Improvement projects give priority to recovery of the T&E species. Conform to approved recovery plans (FLMP Amendment 11, replacement page 66). • Coordinate fuel treatment plans with other resources with input provided by other resource specialists (FLMP Amendment 1, replacement page 92). • Disturbance agents (includes both natural and human-made disturbance agents), such as fire, insects, and pathogens, occur as natural functions within the ecosystem. Over space and time these agents create a mosaic of vegetative species and structural diversity that is characteristic of these forests (ECC EM project DFC). • To minimize the effects of catastrophic events, we identify and employ appropriate preventative measures to manage disturbances when they threaten desired healthy ecosystem functions or significantly endanger life, property or sensitive resources (ECC EM project DFC).

Table 1 (continued)

Existing Conditions	Desired Conditions/Management Direction
Water tanks located in meadows (Barbershop Canyon, Ronny's Tank and Kinder Tank.) are drawing animals to the meadow, affecting vegetation and compacting the meadows. The tanks are also altering natural water flow through the meadows. Systems in Barbershop Canyon, Ronny's Tank and Kinder Tank.	<ul style="list-style-type: none">• Maintain current satisfactory watershed conditions and improve any unsatisfactory conditions to satisfactory by the year 2020 (FLMP p. 74).• Plan and design projects in areas of unsatisfactory or degraded condition to promote channel and streambank stability and to improve the flow and timing of water (FLMP p73).

Table 1: Summary of existing conditions and desired conditions/management direction as outlined in the Coconino National Forest Plan and the East Clear Creek EM project for the East Clear Creek Watershed Health Analysis Area. For specific discussion of existing conditions, please refer to specialist reports contained within the Project Record.

Proposed Action

The following actions are proposed within the boundary of the approximately 70,000 acre analysis area.

Soils and Vegetation

- 1) Burn approximately 10,000 acres over 10 years, in the North, North Battleground, and North Pinchot Pastures and within the old Dude fire to remove decadent grasses, encourage new growth, stimulate browse species, and reduce fuel loadings.
- 2) Remove tanks and rehabilitate tank site(s) from the following meadows to aid in improving vegetative ground cover and improve functioning condition: Upper Barbershop Canyon (3 tanks), Dick Hart Draw (2 tanks).
- 3) Install headcut drop structures to stabilize headcuts and improve functioning condition in the following meadows : General Springs (1 headcut), Houston Draw (6 headcuts), Lockwood Draw (5 headcuts).
- 4) Lay back banks on vertical banks and hydromulch disturbed area with a native seed mix (upland/wetland species) to improve the functioning condition in the following meadows: Houston Draw, Lockwood Draw, Kinder Draw, Dick Hart Draw. Total length is about 3 miles.
- 5) Raise culverts to create ponded wetlands, and install energy dissipaters on the outlet side to improve the functioning condition in the following meadows: Dick Hart Draw, Crackerbox Canyon.
- 6) Rehabilitate or remove any wood structures placed in Buck Springs and Houston Draw that are not functioning properly.
- 7) Maintain the weir at Buck Springs by strengthening the sides with rock riprap to prevent erosion.

Water Quality, Water Quantity, and Water Rights

All actions in this proposal will improve the duration of water flow in the watershed, the following are specific proposed actions for water quality, water quantity, and water rights.

- 1) Remove roadbed to return a natural flow regime and minimize sediments and cutting on previously obliterated roads for a total of 7 miles.

- 2) Stabilize stream crossings and ensure proper drainage and energy dissipaters to minimize sediment production and mitigate flows from 28 roads for a total of 2 miles.
- 3) Install pole fence along road at meadow sections and stream crossings, designate dispersed sites, install energy dissipaters on leadouts, and maintain annually to minimize adverse impacts from Forest Road (FR) 321C from the junction of FR 218C to the southern junction of FR 321 and FR 321C.
- 4) Relocate FR 643A road and rehabilitate old roadbed to remove impacts to Holder Cabin meadow, improve vegetative ground cover and minimize sediment production.
- 5) Pave the following locations and install energy dissipaters on leadouts to minimize sediments from entering into streams: 1) 95 and 96 roads at East Clear Creek and Barbershop Canyons; 2) 95 Road at Bear Canyon; 3) 95 road at Houston Draw; and 96 road at Yeager Canyon.
- 6) Convert closed road to Dane Springs to a trail, ensure drainage is adequate.
- 7) Thin trees up to 12 inches DBH in areas above Merritt, McFarland and Upper Buck Springs to increase duration of flows (approximately 100 acres).

Table 2: Summary of Proposed Action with Lead Functional Areas Identified

Treatment	Major functional area	Unit	PA
Prescribed burning	Fire/watershed	acres	10,000
Remove tanks and rehabilitate site @ Barbershop/Dick Hart	Watershed	sites	5
Install headcut drop structures(Gen Springs)	Watershed	sites	12
Layback banks/hydromulch Houston,Lockwood,Kinder,Dick Hart	Watershed	miles	3
Raise culverts to create ponded wetlands Dick Hart and 321C	Watershed/engineering	sites	3
Rehabilitate or remove structures Buck Springs	Watershed	sites	15
Maintain weir at Buck Springs	Watershed	sites	1
Miles of previously obliterated rds restored	Watershed	miles	7
Stabilize stream crossings	Engineering/watershed	miles	2
Install pole fence along 321C at meadow sections	Recreation/watershed	miles	1.2
Relocate 643A road w/ semi-permeable fill road	Recreation/watershed	miles	.5
Convert closed road to trail Dane Springs	Recreation/watershed	miles	.5
Pave locations on 95/96 roads	Engineering/watershed	sites	4
Thin trees at springs (McFarland, Merritt, and Buck)	Watershed/timber	acres	100

Table 2: Summary of proposed treatments under the proposed action. The table identifies the lead functional areas that will implement the proposed actions, as well as the units of each proposed action.

Project Area

All proposed actions occur within the approximately 70,000 acre analysis area boundary that occurs on the Mogollon Rim Ranger District of the Coconino National Forest, Coconino County, Arizona Township (T) 14 North (N), Range (R) 10 East (E), portions or all of Sections (S) 26, 27, 33, 34,35,36; T14N, R11E, portions or all of S 31-36; T13N, R10E, portions or all of S 1-5, 9-12, 13-16, 23-26, 35, 36; T13N R11E, portions or all of S 1-36; T13N, R12E, S 4-9, 17-20, 29-32; T12N, R10E, portions or all of S 1,2,11,12; T12N, R11E, portions or all of S 1-18, 20-26, 36; and T12N, R12E, portions or all of S 4-9, 16-21, 28-32; Gila and Salt Base Meridian. Refer to Chapter 7, Appendix A for a map of the area).

Objectives and Measures

Objective #1: Maintain existing satisfactory soil conditions and vegetative conditions. Minimize impacts and ameliorate soil conditions at recreation sites, roads and trail system, skid trails and landings. Increase vegetative ground cover to 60-80% of potential in meadows in the 10 years of this plan, and to at least 90% of potential by the year 2020.

Unit of Measurement: Soil condition assessment as outlined in the draft FSM supplement 2554. Soil condition categories are satisfactory, impaired and unsatisfactory.

Objective #2: Re-introduce fire into the ecosystem. Reduce heavy needle mat in some areas, and replace with a diverse grass, forbs and/or shrub community.

Unit of Measure: Acres of prescribed and natural fire.

Objective #3: Maintain existing riparian proper functioning conditions. Improve at-risk and nonfunctional riparian stream reaches to proper functioning condition.

Unit of Measurement: Proper functioning condition assessment as outlined in TR-1737-15 (*A Users Guide to Assessing Proper Functioning Condition and the Supporting Science for Lotic Areas*) and TR-1737-9 (*Process for Assessing Proper Functioning Condition*). Assessment of change in PFC class will be made during the ten-year time period through reach surveys.

Objective #4: Increase the extent of wetted areas.

Unit of Measurement: Change in extent of wetted area over time. Assessment will be at the end of a 10 year time period. Assessment of change will be made during the ten-year time period through surveys.

Objective #5: Increase vegetative diversity and total biomass in riparian areas and meadows, with an emphasis on riparian species.

Unit of Measurement: Change in species composition of plants, and distribution of riparian dependent species over time. Assessment will be at the end of a 10 year time period. Assessment of change will be made during the ten-year time period through surveys.

Objective #6: Manage use by recreationists that is impeding riparian/meadow recovery.

Unit of Measurement: Acres of improvements for recreation through the ten-year.

Objective #7: Improve the transportation system to minimize the effects to meadow and riparian areas.

Unit of Measurement: Miles of road mitigation (maintenance, closure, or decommissioning in meadows and riparian areas).

Decision To Be Made

The District Ranger is the Deciding Officer for this project, and will decide what actions are most appropriate for managing the improving the watershed condition of the East Clear Creek Watershed within the analysis area. The District Ranger may select any of the management alternatives presented here, or may select a management alternative that is different or includes portions of these alternatives.

If a watershed recovery alternative is selected, the District Ranger's decision will include the number of acres treated by fire, the number of miles of channel restoration, the number of tanks to be removed from meadows, the number of miles of road maintenance, the miles of fencing, and the acres of thinning. He will also outline appropriate mitigation measures as well as any potential Forest Plan amendments.

Public Involvement

The proposed action was distributed for review and comment to individuals, organizations and cooperating resource agencies in April 1999 [39] as a part of the Buck Springs Range Allotment Analysis. This scoping generated 2 comments germane to the Watershed Health portion of the analyses [46.11,46.12]. The East Clear Creek Watershed Health Analysis was made a stand alone project by District Ranger Larry Sears in April of 2000 [65] and was distributed for public review second time as a stand alone project [77]. The second round of scoping for the Watershed Health portion generated 4 comments [79,81,82,86]. One additional alternative was created to respond to the single issue raised from the two scoping efforts.

Issues

Issues with the proposed action were developed from public comments and internal concerns generated during interdisciplinary team meetings. Issues are statements of problems to be solved or problems that may be created by the proposed action. Potential issues are collected and analyzed to ascertain which issues are significant in the NEPA context (CFR 40 1500.4(g)). Significant issues are those that meet five criteria.

- Issue is within the scope of the analysis;
- Issue is not decided by law, regulation, or previous decision;
- Issue is related to the decision;
- Issue is amenable to scientific analysis rather than conjecture;
- Issue is not limited in extent, duration or intensity.

Issue #1: The proposed action does not include enough burn acres to achieve the objective of re-introducing fire into the ecosystem.

The proposed action proposed that approximately 10,000 acres be burned within the Buck Springs portion of East Clear Creek. A response received to the proposed action (PA) indicates that the PA does not go far enough to re-create the historic role of fire within the analysis area. This issue was incorporated and addressed in Alternative C. The total number of acres burned will be the unit of measure for this issue. No other significant issues related to this proposal were identified.

Applicable Laws And Executive Orders

Shown below is a partial list of federal laws and executive orders pertaining to project-specific planning and environmental analysis on federal lands. While most pertain to all federal lands, some of the laws are specific to Arizona. Disclosures and findings required by these laws and orders are contained in Chapter 2 of this analysis.

Multiple-Use Sustained-Yield Act of 1960
National Historic Preservation Act of 1966 (as amended)
Wild and Scenic Rivers Act of 1968, amended 1986
National Environmental Policy Act (NEPA) of 1969 (as amended)
Clean Air Act of 1970 (as amended)
Endangered Species Act (ESA) of 1973 (as amended)
Forest and Rangeland Renewable Resources Planning Act (RPA) of 1974 (as amended)
National Forest Management Act (NFMA) of 1976 (as amended)
Clean Water Act of 1977 (as amended)
American Indian Religious Freedom Act of 1978
Archeological Resource Protection Act of 1980
Cave Resource Protection Act of 1988
Executive Order 11593 (cultural resources)
Executive Order 11988 (floodplains)

Executive Order 11990 (wetlands)
Executive Order 12898 (environmental justice)
Executive Order 12962 (aquatic systems and recreational fisheries)
Executive Order 13186 Jan. 11, 2001 (Migratory Bird Treaty Act)

Permits, Licenses, And Certificates

To implement the proposed project as addressed in this EA, various permits must be obtained from federal and state agencies. The following permits will be obtained.

US Army Corps of Engineers

404 Dredge and Fill permit for in-channel treatments.

State of Arizona, Department of Environmental Quality

Air Quality Burn Permits for prescribed burns.

Applicable Legal And Regulatory Requirements And Coordination

Legal Requirements

No further NEPA analysis will be needed. Further environmental reports will be necessary once a decision is arrived at, including a Biological Assessment and Evaluation and Cultural Resource Clearance. These documents must be completed before any activities can be implemented.

Regulatory Requirements

For instream channel activities, State Water Quality Certification and a 404 dredge and fill permit will be required as specified in the Clean Water Act.

Coordination Requirements

Stipulations for coordination of implementation activities will be specified in the Biological Assessment and Evaluation, Cultural Resource Clearance, Best Management Practices for soil and water conservation and 404 permitting procedures.

Project Record Availability

Additional documentation, including more detailed analyses of project area may be found in the project record located at the Mogollon Rim Ranger District office. Additional documentation, including more detailed analyses of project area may be found in the project record located at the Mogollon Rim Ranger District office. These records are available for public review pursuant to the Freedom of Information Act (5 U.S.C.552).

Chapter 1 Purpose and Need
East Clear Creek Watershed Health Environmental Assessment

Copies of the completed EA and the Decision Notice are available at the Mogollon Rim Ranger Station and on the internet at the following addresses:

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CHAPTER 2 ALTERNATIVES

This chapter describes and compares the alternatives considered by the Forest Service for the East Clear Creek Watershed Health project. It includes a discussion of how alternatives were developed, an overview of mitigation measures, monitoring and other features common to all alternatives, a description and map including specific mitigation measures of each alternative considered in detail, and a comparison of these alternatives focusing on the significant issues. Chapter 2 is intended to present the alternatives in comparative form, sharply defining the issues and providing a clear basis for choice among options by the responsible official and the public (40 CFR 1502.14).

Some of the information used to compare alternatives at the end of Chapter 2 is summarized from Chapter 3, “Environmental Consequences.” Chapter 3 contains the detailed scientific basis for establishing baselines and measuring the potential environmental consequences of each of the alternatives. For a full understanding of the effects of the alternatives, readers will need to consult Chapter 3. This chapter describes the following:

- Alternative development process
- Alternatives considered but eliminated from further study
- Alternatives considered in detail
- Mitigation measures
- Comparison of Alternatives
- Preferred Alternative identification

Alternatives Considered But Eliminated From Detailed Study

During scoping, the interdisciplinary team did consider other alternatives and determined that they would not to be carried forward into detailed analysis. The following is a summary of the alternatives, with reasons why they were dropped from further study.

A comment from one citizen [86]⁴ concerns tank removal and the desire not to see tanks removed. The letter further discussed that in the opinion of the commenter, tanks held water on-site. The District Ranger chose not to go forward with an alternative that did not have tank removal because this action is counter to the purpose and need of the analysis, namely that tanks attract animals that compromise soil condition in meadows and they also negatively affect the timing and flow of water through meadow systems. Please refer to pages 4 and 7 of this document for further discussion of the effects of tanks.

⁴ Source documents from the project record are referenced throughout this EA by showing the document number in brackets [#].

Alternatives

The following alternatives for improving the watershed health within the boundaries of the analysis area were fully developed to meet the management objectives and address resource issues, and were analyzed for environmental effects during this planning process. The alternatives include a “no action” alternative and two action alternatives that respond to the purpose and need and issues described in Chapter 1.

As described earlier, alternatives are generated to address a significant issue. During scoping, one significant issue was identified; therefore this environmental assessment will analyze three alternatives. The no action alternative is a requirement of NEPA (40CFR§1502.14 (d)).

Alternative A (No Action) **[65]**

- All current permitted activity will continue to occur within the watershed.
- The road system will remain as is.
- Channel downcutting and channel widening will continue.
- Fire suppression activities will occur.

Alternative B (Proposed Action)

[65](Please refer to Chapter 7, Appendix B for a map of the Proposed Action).

Soils and Vegetation

1) Burn approximately 10,000 acres over 10 years, in the North, North Battleground, and North Pinchot Pastures and within the old Dude fire to remove decadent grasses, encourage new growth, stimulate browse species, and reduce fuel loadings.

2) Remove tanks and rehabilitate tank site(s) from the following meadows to aid in improving vegetative ground cover and improve functioning condition: Upper Barbershop Canyon (3 tanks), Dick Hart Draw (2 tanks).

3) Install headcut drop structures to stabilize headcuts and improve functioning condition in the following meadows : General Springs (1 headcuts), Houston Draw (6 headcuts), Lockwood Draw (5 headcuts).

4) Lay back banks on vertical banks and hydromulch disturbed area with a native seed mix (upland/wetland species) to improve the functioning condition in the following meadows: Houston Draw, Lockwood Draw, Kinder Draw, Dick Hart Draw. Total length is about 3 miles.

- 5) Raise culverts to create ponded wetlands, and install energy dissipaters on the outlet side to improve the functioning condition in the following meadows: Dick Hart Draw, Crackerbox Canyon.
- 6) Rehabilitate or remove any wood structures placed in Buck Springs and Houston Draw that are not functioning properly.
- 7) Maintain the weir at Buck Springs by strengthening the sides with rock riprap to prevent erosion.

Water Quality, Water Quantity, and Water Rights

All actions in this proposal will improve the duration of water flow in the watershed, the following are specific proposed actions for water quality, water quantity, and water rights.

- 1) Remove roadbed to return a natural flow regime and minimize sediments and cutting on previously obliterated roads for a total of 7 miles (see Chapter 7, Appendix C for a list of roads scheduled for proposed treatments).
- 2) Stabilize stream crossings and ensure proper drainage and energy dissipaters to minimize sediment production and mitigate flows from 28 roads for a total of 2 miles.
- 3) Install pole fence along road at meadow sections and stream crossings, designate dispersed sites, install energy dissipaters on leadouts, and maintain annually to minimize adverse impacts from Forest Road (FR) 321C from the junction of FR 218C to the southern junction of FR 321 and FR 321C.
- 4) Relocate FR 643A road and rehabilitate old roadbed to remove impacts to Holder Cabin meadow, improve vegetative ground cover and minimize sediment production.
- 5) Pave the following locations and install energy dissipaters on leadouts to minimize sediment entry into streams at the following locations: 1) 95 and 96 roads at East Clear Creek and Barbershop Canyons; 2) 95 Road at Bear Canyon; 3) 95 road at Houston Draw; and 96 road at Yeager Canyon.
- 6) Convert closed road to Dane Springs to a trail, ensure drainage is adequate.
- 7) Thin trees up to 12 inches DBH in areas above Merritt Springs, McFarland Springs and Upper Buck Springs to increase duration of flows (approximately 100 acres).

Alternative C (Preferred Alternative)

[65, 101](Please refer to Chapter 7, Appendix D for a map of Alternative C-the preferred alternative). Alternative C was created to address the issue of prescribed burning. In addition, the actions within the original proposed action were fine-tuned in this

alternative [100]. Alternative C includes all the actions in alternative B, plus the following:

- Burn approximately 19,700 acres over 10 years, to encourage new growth, stimulate browse species, re-introduce fire into the landscape, and reduce fuel loadings.
- Within the burn acreages, thin ponderosa pine trees up to 12" dbh on approximately 9,200 acres. Sequence of burning/thinning would be to prescribed burn areas first, thin, and then schedule a second burn post thinning within a ten-year time frame (see Chapter 7, Appendix E for a list of location/sites of proposed burn sites).
- Use natural channel design or headcut drop structures to stabilize headcuts and improve functioning condition in the following meadows: General Springs (1), Houston Draw (6), Lockwood Draw (5).
- Remove tanks and rehabilitate tank site(s) from the following meadows to aid in improving vegetative ground cover and improve functioning condition: Upper Barbershop Canyon (3 tanks), Dick Hart Draw (4).
- Raise culverts to create ponded wetlands, and install energy dissipaters on the outlet side to improve the functioning condition in the following meadows: Dick Hart Draw.
- Maintain 643A road by adding 4 rolling dips and keep current road location. Construct 100 yards of pole fence at the edge of the meadow at Holder Cabin to minimize access across the meadow by vehicles. Construct approximately ¼ miles of semi-permeable fill road with raised culverts at the north end of the meadow to create a ponded wetland and to provide access to the recreational site in the trees on the west side of the meadow
- Create an area closure to vehicular traffic of approximately 40 acres at Dane Springs. Convert closed road to Dane Springs to a trail, ensure drainage is adequate. Sign the area closure at the trailhead.
- Minimize impacts to an occupied Little Colorado spinedace site from the 298 road at Dines Tank. Create a 15-acre vehicular closure at Dines Tank/Leonard Canyon crossing. Convert road to Dines Tank and Leonard Canyon to footpath from the existing fence/cattleguard crossing. Drain new footpaths to minimize sediment entry into Dines Tank and Leonard Canyon. At the existing cattleguard/fence, create a parking area for recreationist. Build a walk-through fence of steel posts and sucker-rod on the existing roadbed to eliminate access to the new footpaths. From the new terminus of FR 298, construct energy dissipaters of rock rip-rap on the last 0.3 miles of FR 298 to minimize sediment production into Leonard Canyon.

- Build 0.39 miles of new trail to avoid 2 crossings of General Springs Canyon and one crossing of Box Canyon. Maintain 0.37 miles of existing trail, including one headcut stabilization and waterbars to drain the trail. Maintain 0.15 miles of trail that will access the waterfall in general springs canyon (waterfall trail). Obliterate and rehabilitate 0.16 miles of trail, including removal of steps at the waterfall. Place one footbridge (approximately 70 feet in length) to avoid one crossing of General Springs drainage. Harden crossings for 30 feet on either side of the new crossing on General Springs trail and at the new Crossing above Box Canyon waterfall.
- Obliterate the following roads to minimize road impacts to the aquatic system as identified in the ECC Roads Analysis: 9714X (1.9 miles), 9722W (.9 miles), 9737R (1.0 miles). Obliteration includes removing the old road bed and shape to natural contour, revegetate and disguise the front of the road to discourage use.
- Restore meadow systems by cutting down encroaching ponderosa pine, white fir and Douglas-fir up to 9" diameter at breast height in the following meadows: Buck Springs, Houston Draw, Merritt Draw, Bill McClintock Draw, McClintock Draw, West Moonshine Draw, Barbershop Draw, Holder Cabin Draw, Fred Haught Spring, General Springs, Kinder Draw and Bear Canyon. Lop and scatter slash to two foot and spread slash across meadows.
- Treatments on the 321C road to minimize impacts from vehicular traffic to the meadow system and minimize impacts from the road to the aquatic system.
 1. Meadow at mile 1.1 from south junction, begin pole fence/signage at 1.1 miles for approximately 40 yards. Tie into culvert. Purpose is to keep vehicular access off of meadow.
 2. A spur goes off of 321C to the southeast at approximately milemarker 1.16 (FR321D). Use the first 50 yards of this road as a direct camping spot. From culvert, build pole fence approximately 50 yards along the edge of the spur, cross the road with the pole fence and tie fence into hillside and vegetation. Make a walk-through to the meadow and up the old road bed. Thin about 20 ponderosa pine saplings to make better parking area. Obliterate and rehab road past the direct camping spot. This road was scheduled for obliteration under the M-C sale area improvement plan.
 3. A spur cuts across the meadow on the northwest side of 321C at approximately milemarker 1.3. Need to start a pole fence approximately 30 yards south of this spur and continue to run the fence for approximately 150 yards on the northwest side of 321C to limit vehicular access for the spur at 1.3 miles and a second spur at mile 1.35.

4. Milemarker 1.6-- At draw where exclosure is (unnamed tributary to Dane Canyon). Install pole fence from culverts along southern edge of 321C back to road 9707J. Tie the pole fence into large clump of mixed conifer and ponderosa pine that occurs adjacent to the meadow. This will close a two track road that has developed through the meadow. Close the 9707J road in the following manner: At the clump of mixed conifer and ponderosa pine that continues along the eastern edge of the 9707J road for approximately 30 yards, build another pole fence for approximately 75 yards, 15 feet off the edge of the 9707J road, to allow parking along the edge of the meadow. Build two walk-throughs to allow foot access to well established campsites on the edge of the meadow. Close the road with the pole fence and tie the pole fence into the hillside on the west edge of the 9707J road. Close and drain the remainder of the 9707J road, especially the ATV/4-wheel drive trail that has become established from the end of the road that connects to the 321 road.
5. Milemarker 1.8 At the meadow where the Barbershop Trail crosses the 321C road. Install a pole fence for approximately 200 yards with a walk-through for the trail. To mitigate the road impact, rebuild the drainage and install rock rip-rap energy dissipaters on the drainage outlets.
6. At Bill McClintock Draw (Milemarker 2.1). The 9737R road parallels the meadow and ties into the 321 road. Leave the first 300 yards of the road open, with a pole fence located on the meadow side of the road, with 3 walk-through spots for foot access. Obliterate the remainder of the road and prevent vehicular access on the old road location by turning the pole fence across the road and tie it into the hillside. Create a turnaround at the end of the fence. Install a 1/2 acre steel pipe and sucker rod⁵ elk exclosure (7 course sucker rod) for a total height of 8 feet and install an interpretive sign to explain meadow function and the adverse affects of vehicles and animals to meadow function.
7. Install raised culvert arrays/permeable fills to create ponded wetlands and energy dissipaters on the outlet side of the culverts at 3 road crossings to mitigate the road impact to aquatic species. raised culvert arrays/permeable fills to create ponded wetlands and energy dissipaters on the outlet side of the culverts at 3 road crossings would mitigate the road impacts to aquatic species. The alternatives are further compared by treatment in Table 3 below.

⁵ A steel pipe and sucker rod fence consists the following: 10 foot long, 2 and 7/8" in diameter steel posts cemented into the ground (approximately 2 feet deep) at approximately 15-20 foot intervals. Lengths of sucker rod are welded to the pipe to create a seven coarse fence, approximately 8 feet high. The sucker rod is welded to the steel pipe approximately in one foot increments, beginning 1 foot off the ground.

Table 3: Comparison of Alternatives by Units

Treatment	Unit	Alt A	Alt B	Alt C
Prescribed burning	acres	0	10,000	19,700
Precommercial thinning	acres	0		9,200
Remove tanks and rehabilitate site @ Barbershop/Dick Hart	sites	0	5	7
Natural channel design (Houston,Lockwood)	sites	0		11
Install headcut drop structures(Gen Springs)	sites	0	12	1
Layback banks/hydromulch Houston,Lockwood,Kinder,Dick Hart	miles	0	3	3
Raise culverts to create ponded wetlands Dick Hart and 321C	sites	0	3	4
Rehabilitate or remove structures Buck Springs	sites	0	15	15
Maintain weir at Buck Springs	sites	0	1	1
Miles of previously obliterated rds restored	miles	0	7	7
Stabilize stream crossings	miles	0	2	2
Install pole fence along 321C at meadow sections	miles	0	1.2	1.2
Relocate 643A road w/ semi-permeable fill road	miles	0	.5	0.25
Area closure at Dane Springs	acres	0	0	40
Convert closed road to trail Dane Springs	miles	0	.5	.5
Area closure, Dines Tank	acres	0	0	15
Fence/ trail conversion	miles	0	0	.2
Pave locations on 95/96 roads	sites	0	4	4
Thin trees at springs (McFarland, Houston, and Buck)	acres	0	100	100
Obliterate rds 9714X,9722W and 9737R	miles	0	0	3.8
Re-route general springs trail	miles	0	0	0.39
Obliterate old general springs trail	miles	0	0	0.16
Bridge at general springs	structure	0	0	1
Meadow restoration through thinning	acres	0	0	300

Table 3: Comparison of Alternatives by units.

Alternative Mitigation

To minimize resource impacts, mitigation measures are an integral part of the proposed action. The environmental effects described in Chapter 3 are predicted with the assumption that these measures would be implemented. Mitigation measures included are based on Best Management Practices (BMPs) found in the USFS Southwestern Region's Soil and Water Conservation Handbook (FSH 2509.22), the Coconino Forest Plan, and site-specific needs. The following mitigation measures listed in Table 4 apply to Alternatives B and C.

Preferred Alternative Identification

In this environmental assessment the agency's preferred alternative is **Alternative C**. Unless public comments to the EA sway the decision maker, this would be the alternative that would be implemented. **Alternative C** achieves the objectives by providing for the needed recovery of riparian aquatic and floristic species through

channel and meadow restoration efforts on a greater scale than Alternative B; it addresses the need to re-introduce fire into the landscape on a larger scale than Alternative B and further reduces the fire risk by precommercially thinning 9,200 acres; it provides for a transportation system that minimizes impacts to the watershed; and it minimizes impacts from recreation activities to meadow systems at General Springs, Holder Meadow, and along the 321C road. **Alternative C** best meets the objectives outlined for the East Clear Creek Watershed Health Analysis Area. **Alternative C** best meets the objectives outlined for the East Clear Creek Watershed Health Analysis Area.

Chapter 2 Alternatives
East Clear Creek Watershed Health Environmental Assessment

In Table 4, the **Effectiveness** column is included to give the reader an idea of how well these mitigation measures work from past experiences and/or research. The numbers correspond to the following results:

1. Almost always reduces impacts significantly. Almost always done in this situation.
2. Usually reduces significant impacts. Often done in this situation.
3. Effectiveness monitoring will be conducted during project implementation & other appropriate times.

Table 4 -- Mitigation Measures for Alternatives B and C

ID#	BMP #	Mitigation	Why	Effectiveness
Soil and Water				
SW1	BMP #1	On areas to be prescribed burned, fire prescriptions should be designed to minimize soil temperatures over the entire area. High intensity fire should occur on 5% or less of the entire area. Fire prescriptions should be designed so that soil and fuel moisture temperatures are such that fire intensity is minimized and soil health and productivity are maintained.	To maintain long-term soil productivity.	1
SW2	BMP #2	On areas to be prescribed burned, retain 5-10 tons/acre of course woody debris be left on-site after the prescribed burns to maintain long-term soil productivity on areas to be burned outside of the buffers around private land.	To maintain long-term soil productivity.	1

Chapter 2 Alternatives
East Clear Creek Watershed Health Environmental Assessment

ID#	BMP #	Mitigation	Why	Effectiveness
SW3	BMP #3	On areas to be prescribed burned, establish filter strips averaging 1 chain (66 feet) buffer on each side of riparian streamcourses and an average of ½ chain (33 feet) buffer on each side of non-riparian streamcourses to filter sediments that will occur from the burn. Do not ignite fuels within this buffer area. Some creep may occur into the buffer, but an average of width by stream type will be maintained.	To minimize sediment and/or ash delivery into drainages and maintain water quality.	1
SW4	BMP #4	Do not operate equipment in filter strips of riparian and non-riparian drainages. The prescribed width is 1 chain (66 feet) on <i>either</i> side of the riparian drainages and ½ chain (33 feet) on <i>either</i> side of the non-riparian drainages throughout the analysis area. Exceptions to this include stream channel restoration in Houston Draw, Kinder Draw, Lockwood Draw, Dick Hart Draw, Barbershop Canyon, Buck Springs Canyon, and stream channel shaping on previously obliterated roads.	To minimize sediment delivery into drainage.	1
SW5	BMP #5	Do not operate equipment when ground conditions are such that soil compaction can occur.	To minimize soil compaction, soil detachment & sediment transport. To maintain long-term soil productivity.	1
SW6	BMP #6	Site rehabilitation on upland sites: Seed at 5 pounds/acre with native seed mix. Potential vegetation for individual sites should utilize the Coconino National Forest Terrestrial Ecosystem Survey to identify species to be utilized. Protect site with slash spread across the disturbed area to create microclimates and protect from grazing ungulates.	To minimize soil erosion and minimize noxious weed spread.	1
SW7	BMP #7	Site rehabilitation on riparian sites: Seed at 5 pounds/acre with native seed mix to rehabilitate the site and minimize impacts of noxious weeds. Potential vegetation for individual sites should utilize the Coconino National Forest Terrestrial Ecosystem Survey to identify species to be utilized. Protect site with	To comply with State and Federal water quality standards by minimizing soil erosion through the stabilizing influence of	1

Chapter 2 Alternatives
East Clear Creek Watershed Health Environmental Assessment

ID#	BMP #	Mitigation	Why	Effectiveness
		temporary 8' high ungulate proof fence until plants are established.	stabilizing influence of vegetation ground cover. Minimize noxious weed spread.	
SW8	BMP #8	Install silt fences downstream from ground-disturbing activities in stream channels to minimize the chance of sediment being lost downstream during construction and until revegetation is completed.	To comply with State and Federal water quality standards by minimizing sediment delivery to drainages.	1
SW9	BMP #9	Bring rock material from an upland site for drop structure construction in General Springs Draw, Houston Draw and Lockwood Draw.	To minimize disturbance in drainage systems and minimize sediment production within channel.	1
SW10	BMP #10	Site rehabilitation on disturbed sites at Houston Draw, Kinder Draw, Lockwood Draw, Dick Hart Draw, Barbershop Canyon, and Buck Springs Canyon; and stream channel shaping on previously obliterated roads: Site rehabilitation consists of several revegetation methods, such as: 1) Store sod removed from the initial ground disturbance and replace the sod from the top of the bank on the disturbed site; 2) Seed with a native seed mix (see BMP # 6 above) Where it is physically possible, hydromulch of seed is the preferred application method. Due to the remoteness of some of the proposed sites, this may not be possible; 3) Protect site with slash spread across the disturbed area to create microclimates and protect from grazing ungulates. Slash placement will be limited to the upper 2/3 of the bank to limit transport downstream of woody material; 4) Fence out ungulates for 1 to 2 years (or until the site has re-established); 5) use using mycorrhizal inoculum on severely disturbed sites where no topsoil is left.	To comply with State and Federal water quality standards by minimizing soil erosion through the stabilizing influence of vegetation ground cover. Minimize noxious weed spread.	1
SW11	BMP #11	Do not borrow road fill or embankment materials from the stream channel or meadow surface on road maintenance projects. End-load all material hauled on-site and compact fill.	To minimize disturbance in drainage systems and minimize sediment	1

Chapter 2 Alternatives
East Clear Creek Watershed Health Environmental Assessment

ID#	BMP #	Mitigation	Why	Effectiveness
			production within channel.	
SW12	BMP #12	Use riprap or velocity checks to stabilize or disperse outfall on road maintenance projects. Do not use lead in or lead out ditches without velocity checks.	To minimize sediment delivery into drainage.	2
SW13	BMP #13	Plant plugs of rushes, sedges, and spike rushes at Houston Draw, Dick Hart Draw, and Buck Springs Canyon to improve success of regeneration efforts. Fence with ungulate proof fencing for 1 to 2 years (or until plants are established) if grazing is inhibiting regeneration efforts.	To comply with State and Federal water quality standards by minimizing soil erosion through stabilization of ground cover. Minimize noxious weed spread.	2
SW14	BMP #14	On areas that have had roads previously obliterated and the remaining roadbed will be removed, add slash/or erosion mat and seed to the disturbed areas.	To add surface roughness and to diminish the impact of the first rain event and to speed recovery of the site.	1
SW15	BMP #15	Do not blade roads when the road surface is too dry. If the road surface is too dry, a water truck can apply water, or the project can be scheduled for when adequate moisture occurs to complete the project.	To minimize sediment detachment.	2
SW16	BMP #16	On areas where poles will be harvested for pole fences, do not skid across meadows or riparian streams. If skidding has to occur across a non-riparian streamcourses\, designate any crossing prior to skidding.	To minimize impacts to streams and soils in meadows from tree harvesting operations.	1
SW17	BMP #17	Skid trails and obliterated roads will have slash placed on the trail or cross-ditched (waterbarred) to break the energy flow of water. Slash will be placed by hand on skid trails. This is the preferred method to dissipate the energy flow of water.	To minimize soil erosion.	1
SW18	BMP #18	Landing and pole peeling locations will be in upland positions and out of riparian and non-riparian filter strips stated in BMP #4.	To minimize sediment delivery into drainage.	1
SW19	BMP #19	Install straw waddles and erosion cloth barriers on either side of the culvert reconstruction to minimize concrete and sediment entry into Dick Hart Draw, Houston Draw on Forest Road 95 and Crackerbox Canyon on Forest Road 123 and 300.	To minimize sediment delivery into drainage.	1
SW20	BMP #20	Use a hardened surface for at least 50 feet either side of stream crossings to minimize sediment impacts to streams from the trail	To minimize sediment	2

Chapter 2 Alternatives
East Clear Creek Watershed Health Environmental Assessment

ID#	BMP #	Mitigation	Why	Effectiveness
	#20	crossings to minimize sediment impacts to streams from the trail crossings.	delivery into drainage.	
SW21	BMP #21	Rehabilitate obliterated trail to natural contour. Revegetate as per BMP's 6 and 7.	To minimize soil erosion and minimize noxious weed spread.	1
SW22	BMP #22	All fueling of vehicles will be done on a designated protected, upland site. If more than 1320 of gallons of petroleum products are to be stored on site above ground or if a single container exceeds 660 gallons, then a spill prevention control and countermeasures plan (SPCC) will be prepared as per 40 CFR 112).	To prevent contamination of waters from accidental spills.	1
SW23	BMP #23	If construction crews are to live on-site, then an approved camp and suitable sanitation facilities must be provided.	To protect surface and subsurface water from unacceptable levels of bacteria, nutrients and chemical pollutants.	1
SW24	BMP #24	Implement Best Management Practices prior to project implementation.	To minimize impacts to soil and water resources from project implementation, to minimize non-point source pollution, to adhere to the Clean Water Act, and to adhere to the intergovernmental agreement between Region 3 of the Forest Service and the Arizona Department of Environmental Quality.	1
SW25		Complete all required permitting (404 permits) and Water Quality Certification (if necessary), prior to project implementation.	To comply with Clean Water Act provisions and the	1
Vegetation				

Chapter 2 Alternatives
East Clear Creek Watershed Health Environmental Assessment

ID#	BMP #	Mitigation	Why	Effectiveness
V1		Identify staging area for heavy equipment	To protect existing vegetation surrounding project sites from damage during construction activities.	1
Wildlife (Threatened and Endangered Species)				
W1		<p>Consult with US Fish and Wildlife Service (FWS) on the impacts of the preferred alternative on T&E wildlife, fish or plant species, and any appropriate mitigation measures prior to selecting a final management alternative. Specific recommendations include the following:</p> <ul style="list-style-type: none"> • Implement soil and water Best Management Practices (BMP's) to mitigate erosion from entering streams when working at stream crossings (see BMP list above). • All activities that occur within Mexican spotted owl Protected Activity Centers will be implemented outside of the breeding season. • Construction activities that occur within a Little Colorado spinedace stocked stream should occur in the fall to minimize impacts to the spinedace. Sediment reduction BMP's must also be implemented on these projects. • Conduct burning and thinning activities within ¼ mile of goshawk PFAs outside of the breeding season. • Conduct microhabitat monitoring in MSO restricted habitat prior to burning or thinning. • Survey riparian habitats prior to tank removal, channel re-shaping, or road crossings on riparian streams for Chiricahua leopard frogs and sensitive riparian associated insects or plants. 	To mitigate activities that may affect Threatened and Endangered species.	1
W2		Snags will be protected in all prescribed burns by either lining, foaming or avoidance.	To protect habitat components for cavity dependent species.	1
Noxious Weeds				

Chapter 2 Alternatives
East Clear Creek Watershed Health Environmental Assessment

ID#	BMP #	Mitigation	Why	Effectiveness
N1		Minimize disturbance to the existing native plant population during project implementation, and take care not to introduce seeds of unwanted plants. To minimize rates of spread, clean vehicles, equipment and personal gear if they have been in an infested area. Use only certified, weed free seed to re-vegetate areas, and weed free hay if hay is used as a mulch for projects. Conduct post-project implementation monitoring to insure no noxious weeds were introduced or become established. Control or eliminate established populations of noxious weeds as allowed on the Coconino National Forest.	To minimize the spread or introduction of noxious weeds.	1
Air				
A1		Adhere to all state regulatory standards. Coordinate prescribed burning projects to meet State air quality standards. Obtain approval for burning from the Arizona Department of Environmental Quality before all prescribed burns.	To minimize effects within the airshed.	2 & 3
Human Environment				
H1		Conduct heritage surveys on the analysis area in consultation with the State Historic Preservation Office (SHPO) & locate all areas not to be disturbed.	To protect & preserve heritage resources in the analysis area.	1
H2		If any heritage resource sites are discovered during construction and clearing, stop all operations immediately and contact the COR	To protect & preserve heritage resources in the project area.	1
H3		During construction, post traffic caution signs at critical locations.	To protect and caution the traveling public of heavy equipment in the area.	1

Table 4: Mitigation measures outlined for the East Clear Creek Watershed Health Analysis. The table identifies the mitigation ID #, the BMP #, a description of the mitigation measure, the need for the mitigation measure and the relative effectiveness of the mitigation measure.

CHAPTER 3 AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

Introduction

This chapter describes the following:

- What are effects?
- Affected environment and effects to the significant issue
- Affected environment and effects to resources
- Cumulative effects
- Description of relevant past, present, and reasonably foreseeable future actions not part of the proposed action
- Predicted obtainment of objectives

The discussions of resources and potential effects take advantage of existing information included in the Coconino Forest Plan's FEIS, other project NEPA, project-specific resource reports and related information, and other sources as indicated. Where applicable, such information is briefly summarized and referenced to minimize duplication. The planning record for the East Clear Creek Watershed Health project includes all project-specific information, including resource reports, the watershed analysis, and other results of field investigations. The record also contains information resulting from public involvement efforts. The planning record is located at the Long Valley Ranger District Office in Happy Jack, Arizona, and is available for review during regular business hours. Information from the record is available upon request.

Analyzing Effects

Environmental consequences are the effects of implementing an alternative on the physical, biological, social and economic environment. The Council on Environmental Quality (CEQ) regulations implementing the National Environmental Policy Act (NEPA) includes a number of specific categories to use for the analysis of environmental consequences. Several are applicable to the analysis of the proposed project and alternatives, and form the basis of much of the analysis, which follows. They are explained briefly here.

Direct, Indirect and Cumulative Effects

Direct environmental effects are those occurring at the same time and place as the initial cause or action. Indirect effects are those that occur later in time or are spatially removed from the activity, but would be significant in the foreseeable future. Cumulative effects result from incremental effects of actions, when added to other past, present, and reasonably foreseeable future actions, regardless of what agency or person undertakes such other actions. Cumulative effects can result from individually minor, but collectively significant, actions taking place over a period of time.

Unavoidable Adverse Effects

Implementation of any action alternative would cause some adverse environmental effects that cannot be effectively mitigated or avoided. Unavoidable adverse effects often result from managing the land for one resource at the expense of the use or condition of other resources. Many adverse effects can be reduced, mitigated or avoided by limiting the extent or duration of effects. The interdisciplinary procedure used to identify specific practices was designed to eliminate or lessen the significant adverse consequences. The application of Forest Plan standards and guidelines, Best Management Practices, project-specific mitigation measures, and monitoring are all intended to further limit the extent, severity, and duration of potential effects. Such measures are discussed throughout this chapter. Regardless of the use of these measures, some adverse effects will occur. The purpose of this chapter is to fully disclose these effects.

Short-term Use and Long-term Productivity

Short-term uses, and their effects, are those that occur annually or within the first few years of project implementation. Long-term productivity refers to the capability of the land and resources to continue producing goods and services long after the project has been implemented. Under the Multiple-Use Sustained-Yield Act, and the National Forest Management Act, all renewable resources are to be managed in such a way that they are available for future generations. Harvesting and use of standing timber is an example of short-term use of a renewable resource. This long-term productivity is maintained through the application of the resource protection measures described in Chapter 2, in particular those applying to the soil and water resources. These are also discussed throughout this chapter, in particular for soil, riparian and watershed condition.

Irreversible and Irretrievable Commitments

Irreversible commitments are decisions affecting non-renewable resources such as soils, wetlands, unroaded areas, and cultural resources. Such commitments are considered irreversible because the resource has deteriorated to the point that renewal can occur only over a long period of time or at a great expense, or because the resource has been destroyed or removed. The construction of roads for timber harvesting is an irreversible action because of the time it takes for a constructed road to revert to natural conditions without mitigative actions. Irreversible and irretrievable commitments are discussed as applicable, although not usually by use of those terms. See the discussions of riparian areas and soils for discussions on irreversible commitments within the analysis area.

Available Information

There is less than complete knowledge about many of the relationships and conditions of wildlife, fish, forests, jobs and communities. The ecology, inventory and management of a large forest area are a complex and developing science. The biology

of wildlife species prompts questions about population dynamics and habitat relationships. The interaction of resource supply, the economy, and communities is the subject matter of an inexact science. However, the basic data and central relationships are sufficiently well established in the respective sciences for the deciding official to make a reasoned choice between the alternatives, and to adequately assess and disclose the possible adverse environmental consequences. New or improved information would be very unlikely to reverse or nullify these understood relationships.

Plans of Other Agencies

The CEQ regulation implementing NEPA require a determination of possible conflicts between the proposed action and the objectives of federal, State, and local land use plans, policies, and controls for the area. The major land use regulation of concern is the annual Arizona Game and Fish Hunting and Fishing Regulations. See the “Findings and Disclosures” section of Chapter 2 for a discussion of compliance with these laws. State compliance is also discussed at the end of Chapter 1.

Environmental Effects And The Significant Issues

This section will discuss the affected environment and the affects of the proposed alternatives to the issues raised in the analysis.

Issue #1 The proposed action does not include enough burn acres to achieve the objective of re-introducing fire into the ecosystem.

Affected Environment

Dead and Down Fuels - Dead and down fuel loadings range across the analysis area from a low of 3 tons per acre to a high of 30+ tons per acre. The source of these fuels is a combination of slash from past timber harvest and treatment activities (logging, pulping, and precommercial thinning), and naturally occurring fuels (tree blow-downs, tree breakage, pine needlecast, hardwood leaf fall, mortality of annual and perennial grasses, etc.).

Live Fuels - The predominate component of live fuels loadings are trees, but also includes shrubs and grasses. Historically most of the analysis area consisted of open-grown stands of ponderosa pine (averaging 30-50 square feet of basal area per acre) with scattered large Gambel oak, and a well-established grass understory. Today, the overstory is heavily stocked with ponderosa pine, ranging from 100-150 square feet of basal area over much of the analysis area, with scattered Gambel oak of all sizes, and a ground cover consisting of pine needles and duff and little grass. The heavy stocking in ponderosa pine is an increase in the existing amount of biomass as compared to historic levels. As a by-product, this additional biomass produces a substantial increase in dead/down material [32,102].⁶

⁶ Source documents from the project record are referenced throughout this EA by showing the document number in brackets [#].

Effects of Alternative A

This alternative does not address issue #1, it merely continues the trend of increasing fuel loadings over time. Direct effects will be to maintain current live and dead fuel loadings. Indirect effects will be to increase fuel loadings over time. Cumulative effects are an increase in fuel loadings. This will increase the threat of large stand-replacing wildfires over time [102].

Effects of Alternative B and C

Alternative B will meet the objective through a direct effect of reducing dead fuel loading on 10,000 acres and reducing live fuel loading on 1,500 acres through precommercial thinning. The burning of 10,000 acres meets the objective of re-introducing fire on these acres. The indirect and cumulative effects over time increase over time as fuels build back up through in-growth and natural processes [102]. There is a need for further actions in the future to maintain the positive benefits of the burn acres over time.

Alternative C will meet the objective through a direct effect of reducing dead fuel loading on 19,700 acres reducing live fuel loading on 9,200 acres through precommercial thinning. The direct, indirect and cumulative effects are the same as Alternative B, only they occur on greater acreage [102]. Alternative C meets the objective best of all alternatives because of the larger acreage associated with the alternative.

Cumulative Effects

The cumulative effect of past management practices to suppress wildfire has the largest impact on forest fuels within the analysis area. This practice has allowed for a large accumulation of live fuels to occur. As such, alternative A will have the greatest potential indirect effect from past cumulative activities to the analysis area through an increased threat of stand-replacing wildfire. Overall, alternative C will provide the best alternative to decrease fuel loading of all of the alternatives.

Environment And Effects Of Other Resources

This section displays the effects to the main resources (soil, water, wildlife, air, and vegetation) not covered by the issues section above, as well as economics, recreation and visual quality and cultural resources.

Effects to Soil Resources [22, 22b]

Affected Environment

The following is a brief discussion of existing soil conditions within the analysis area. A map of the life zones and soil condition is included in Chapter 7, Appendix F.

Mixed Conifer Forest Life Zone This life zone consists of ecological units 650, 651, and 652. Soil condition is generally satisfactory. Soils are functioning normally and properly due to adequate vegetative ground cover provided by needle casts, oak leaves, woody debris and perennial vegetation such as grasses, forbs, and shrubs. Total acres of satisfactory soil condition within the mixed conifer life zone are approximately 23,541. There are pockets of ecological unit 650 identified as being impaired signifying a reduction of soil quality. As a result of past timber harvesting activities, this ecological unit has been subjected to intensive machine piling, skid trails, landings and burning activities which have resulted in small, localized areas of soil displacement and extensive areas in which significant amounts of coarse woody debris have been removed. The acres of impaired soil conditions are small (generally less than $\frac{1}{4}$ acre in size) and are not mapable within this unit, but are thought to occur on approximately 5% of the land unit (approximately 300 acres). The road system within this life zone displays unsatisfactory soil conditions [22,22b].

Ponderosa Pine Forest Life Zone This life zone consists of ecological units 546, 549, 550, 555, 567, 578, and 584 and soil condition is generally satisfactory. Satisfactory soil condition indicates that the inherent productivity capacity of the soil resource is being sustained with respect to all soil functions. Total acres of satisfactory soil condition within the ponderosa pine life zone are approximately 39,590. There are pockets of ecological unit 546 identified as being impaired signifying a reduction of soil quality for the same reasons as ecological unit 650 state above. The acres are not mapable within this unit, but it is thought to occur on approximately 5% of the land unit (approximately 1,700 acres). The road system within this life zone displays unsatisfactory soil conditions [22,22b].

Meadow Life Zone Ecological unit 53 is the Meadow Life zone. Unsatisfactory soil condition exists in a majority of the unit due to soil compaction resulting in a loss of organic matter in the soil surface A horizon on the dominant plant community within the unit, namely the Poa dominated grass community. Exceptions to this are in total ungulate exclosure areas within Buck Springs, Merritt and Houston Draws, where soil conditions are satisfactory.

As a result, increased runoff has contributed toward the establishment of gully erosion, especially within stream channels associated with ecological unit 53. Increases in water volumes and higher peak flows are a result of an increase in overland flows from adjacent compacted soils. Poorly located and maintained roads contribute to stream channels receiving excessive runoff in the form of increased water volumes and higher peak flows. The result is the presence of gullies, some of which are more pronounced than others. This indicates a system of unstable stream channels.

Tanks located in meadows also contribute to increased use. Permanent waters can result in denuded sacrifice areas around watering points (Stoddart et al,1975) but can also be used to improve utilization across a grazed area. Within the analysis area, Barbershop Tanks, Ronny's Tank, Kinder Tank, and Goddard Tank (on private) are

drawing ungulates into the meadows. The springs and streams associated with many meadows draw ungulates to these areas. Total acres of unsatisfactory soil condition, which exist within ecological unit 53, are 412 [22,22b].

Effects of Alternative A

A thorough discussion of effects to soil resources from Alternative A can be found in the Soil and Water Effects Analysis [104]. Soil resources are not expected to improve with Alternative A. None of the objectives for soil and water resources will be met with this alternative. Table 5 displays the summary of effects to soil resources for this alternative and a more thorough discussion of the effects of Alternative A can be found in the Soil and Water Effects Analysis [104].

Effects of Alternative B and C

Alternatives B and C are the action alternatives that have several treatments designed to improve and or maintain soil conditions. All of the treatments involve some amount of ground disturbance (except the designation of area closures at Dane Springs and Dines Tank in alternative 3), and as such, provide short-term direct negative effects to soil because it affects the soils ability to resist degradation (erosion). As such, all of the treatments have Best Management Practices (BMP's) applied to mitigate any negative adverse impacts. A list of the Best Management Practices germane to soil resources can be found in the mitigation section of this EA (Chapter 2, Table 4). The BMP's that apply to each individual project are outlined in the Soil and Water Effects Analysis [104].

Indirect effects are primarily positive to soil condition that occur both on-site and off-site for both alternatives. These include on-site benefits that occur over time as site conditions improve and off-site benefits to adjacent sites. Table 6 displays a summary of the acres/miles/# of structures for each action within each alternative, as well as how these actions meet the 7 objectives for the analysis. Further specific effects for each action are displayed in the Soil and Water Effects Analysis [104].

Cumulative Effects

Cumulative effects that affect soil resources include fire suppression, past road construction and current road management, past and present grazing, and recreation use within the analysis area. Soil and water effects are commonly viewed on the 5th-code watershed level (East Clear Creek) and the following discussion will refer to the analysis area, as well as the watershed.

The positive effects to soils described through the activities in the action alternatives will be tempered most from current grazing activities within the analysis area and within East Clear Creek. Current management of livestock is being analyzed simultaneously with the Buck Springs Environmental Impact Statement, and the preferred alternative to graze cattle will greatly minimize the impacts to soil resources throughout the watershed. Wild ungulate grazing, and in particular elk grazing, will have the greatest impact on the successful improvement of soil and water resources through the actions

stated in alternatives B and C [76,99,104,105,107]. Unfettered elk will continue to negatively affect the recovery of riparian resources throughout the watershed and the analysis area. Prescribed Best Management practices for protection measures after treatments, and in particular, elk-proof fencing, will improve the chance for successful effects to soil conditions from the proposed treatments. In addition, actions by the Arizona Game and Fish Department to reduce elk numbers will also improve the chances for success of the proposed treatments.

The proposed actions to minimize impacts from roads do not address the entire watershed, and as such, will not minimize all impacts from roads within the watershed. The Roads Analysis [98] for the East Clear Creek Watershed identified roads that were negatively impacting soil and watershed attributes. Alternatives B and C address the roads within the watershed that occur within the project area. Cumulatively, the proposed actions for road management will begin to minimize impacts from roads within the watershed. The actions proposed within this analysis will also address current impacts from recreation within the analysis area, but will not address all of the watershed related recreation impacts to soil and water resources. The proposed recreation-related activities will begin to minimize recreation impacts, however, recreation impacts are expected to increase as the population of Arizona increases, so cumulatively, there are expected to be increased impacts from recreationists throughout the analysis area and the watershed as a whole. The current Arizona OHV Forest Plan Amendment - For Apache-Sitgreaves, Coconino, Kaibab, Prescott, and Tonto National Forests may address off-road use that will minimize impacts from off-road vehicle use.

As discussed, Alternative C will provide the greatest benefit to soil resources in the long-term, but will also provide the greatest potential short-term direct impacts from construction and fire activities. Alternative B will provide a smaller amount of long-term improvement to soil conditions, but not as great as Alternative C. Alternative A has the least amount of direct impact to soil resources from construction activity, but maintains poor soil conditions and excessive erosion from headcuts and vertical banks. Alternative A also has the greatest potential for a large stand replacing fire, which would have a direct and indirect negative effect to soil resources.

Overall, the actions proposed in Alternatives B and C does not examine the entire watershed. The actions, as proposed in these alternatives will improve soil and water conditions within the watershed and will not have a detrimental, long-term cumulative effect to soil resources. Alternative A will not improve soil conditions and in combination with the current stressors on the system (grazing, roads, recreation use and threat of large wildfire) may have a negative cumulative impact to soil resources in the long run. Further work within the watershed will be necessary to improve soil conditions watershed-wide.

Effects to Wildlife **[23,24,25]**

Affected Environment

Wildlife species are integral components of the ecosystem that make up the ECC Watershed Health analysis area. The area has seen changes in the populations since pre-European settlement, with some species extirpated from the area (Merriam's elk, grizzly bear, and Mexican wolf) while some are recent additions to the biota (Rocky Mountain elk, feral pigs, starlings, rainbow trout, green sunfish, crayfish). The following describes the affected environment of wildlife (including threatened, endangered species) within the analysis area.

Elk: Merriam's elk was the native elk of Arizona and the southwest, but was extirpated by the 1920's. Rocky Mountain elk from Wyoming were transplanted to the Sitgreaves National Forest south of Winslow in 1913 (Roberts 1930). By 1928, 217 head had been released into several remote woodland areas of Arizona. These elk rapidly expanded their numbers and their range, and in 1935 the first hunting season was instituted. Today the elk population in the East Clear Creek Ecosystem Assessment Area is one of the densest in the state.

Elk populations dramatically increased in the mid 80's through early 90's. The state population in 1980 was estimated at approximately 10,000 adults after the hunting season, increasing to 30,000 adults post-hunt in 1989 and then stabilizing. Individual herd areas differed, however the elk population in the East Clear Creek watershed exhibited a similar pattern with increases until 1993. Evidence of elk impacts on vegetation was first noticed in the riparian meadows and in seeded areas following timber harvest, particularly those areas seeded with orchard grass. Despite reductions in the elk population since 1993, impacts to riparian areas and meadows are still substantial. Elk often come into the same meadows and riparian areas each night to feed, reducing the cover and vigor of highly palatable plants, trampling channels and breaking down streambanks. When elk concentrate in the headwater meadows, they alone can exert enough grazing pressure to prevent the formation of sponge meadows. The effect of elk grazing has been demonstrated at the Buck Springs, Houston Draw, Merritt Draw, Double Cabin, and Open Draw elk exclosures, where vegetative and soil conditions are vastly improved inside the exclosure from those areas found outside the exclosure that are grazed only by elk and areas grazed by both elk and livestock.

Deer: There are two species of deer in the analysis area. The mule deer are the more common species and tend to frequent the higher elevations with ponderosa pine and mixed conifer in the summer, moving into the pinyon-juniper habitats in winter. The less common Coue's white-tailed deer frequent the woodland communities, remaining in areas with mixtures of oak-juniper-pinyon pine, usually near the canyon edge.

Mule deer are found in a variety of habitats from deserts to mountains. They tend to occupy scrub oak, mountain mahogany, skunk bush, buckthorn, and manzanita habitat. Habitat needs include water within one mile, cover, and foods high in protein. Rugged topography provides cover in more open areas. Food preferences include new shoots, herbaceous plants, fruits, and forbs. Arizona Game and Fish data suggests that mule deer are decreasing throughout the west and on the Forest. Increasing browse species and understory vegetation will improve deer habitat.

White-tailed deer in Arizona eat high amounts of browse in late fall and winter and forbs in spring. Their diet selection appears to be driven by the availability of forbs. When forbs are low, the amount of shrubs consumed increases. Grasses, cacti, and other food sources appear to be used infrequently. Arizona Game and Fish data suggests that white-tail deer populations are stable on the Forest.

Turkey: Turkeys require different habitat types for different behavioral activities. Roosting habitat is located in tall, over-mature ponderosa pines with widely spaced spreading branches. For breeding, males prefer to display in small openings, edges of large openings or beneath forested habitats with open understories. Nesting hens show an affinity for slopes greater than 30% with high canopy closure with a “guarded side provided by a tree trunk, rock, lock shrub clump, or thicket of young trees, and an open side for an escape route. Brood habitat is critical for nesting hens and young poults, and includes openings, riparian areas, springs and seeps, burns, aspen stands, and flood plains. Invertebrate abundance is important and is related to herbaceous productivity. Openings near cover are preferred. Loafing sites occur in the adjacent forest within 50-60 feet of openings. They typically have a dense overstory, an open understory with good visibility, and logs, slash, or rock outcrops used as perches. Turkey surveys on the Forest indicate that populations decreased in the early 90’s and have shown increases in recent years. Overall, they are considered stable.

Bear: The analysis area provides most of the bear habitat found on the Mogollon Rim District. Drainages with dense mixed conifer shelter mothers with cubs during the spring and summer. Studies during the 1980's indicated that the number of breeding females had dropped extremely low. A moratorium on hunting was implemented around 1988. When number of bears had increased to levels where conflicts were occurring with campers and residents, a hunting season was renewed with a cap of two female bears (1995). Though bears will never be abundant on the analysis area due to poor food availability, the population appears to be stable at the present time according to the Arizona Game and Fish Department.

Fish: Two of three reservoirs that provide fishing opportunities on the District, are located within the analysis area. Blue Ridge Reservoir and Knoll Lake are stocked during the spring and summer months with rainbow trout. Brook and brown trout were also stocked in the past. Conflicts with endangered native fish resulted in no stocking for two years. Present agreements allow stocking of tagged fish, with creel surveys below the dams to determine if fish are getting into the main drainages of East Clear Creek and Leonard Canyon. Several species of bait fish are also established in the reservoirs and the drainages, such as fathead minnows, golden shiners, red shiners and crayfish. These non-native fish are competitors and predators on the native fish, with detrimental effects to the threatened Little Colorado spinedace (ECC 1999).

Non-game fish include natives such as bluehead sucker, speckled dace, Little Colorado sucker, roundtail chub and the Little Colorado spinedace. Aquatic systems are very

limited in the southwest, and are impacted by activities such as livestock grazing, wildlife grazing, and recreation activities [25].

Birds: The analysis area provides habitat for many birds, including neotropical migrant birds, resident species, raptors, and threatened and endangered species. Primary migratory birds include the northern goshawk, Mexican spotted owl, olive-sided flycatcher, cordilleran flycatcher, purple martin, red-naped sapsucker, MacGillvary's warbler, and the red-face warbler. Ponderosa pine and mixed conifer habitats provide some or all of the habitat requirements for 139 species of birds (USDA, 1996). Small pockets of aspen, mixed hardwoods (oak, maple, aspen), and meadows are limited in area, but are very important to many species. Studies of songbirds in ponderosa pine forests have found a range of 22 to 31 breeding species (Szaro and Balda 1979). Warblers in most western coniferous forests account for 7-20% of individuals.

Raptors: Many species of raptors are found on the analysis area. All three accipiters (sharp-shinned hawk, Cooper's hawk, northern goshawk) are relatively common, while red-tailed hawks are abundant. Bald eagles use the area during the fall and winter months. Golden eagles generally frequent open habitat, especially grasslands, though they may be found in open coniferous forest. The analysis area may provide marginal habitat, but sightings are much more common to the north of the analysis area in the open woodlands and grasslands. Osprey frequents the large reservoirs, with a nest at Blue Ridge Reservoir and at Knoll Lake. Zone-tailed hawks also nest near Blue Ridge Reservoir. Peregrine falcon, northern goshawk, and bald eagle are discussed in more detail under threatened, endangered, and sensitive species.

Waterfowl: The analysis area has few wetlands. The Blue Ridge Reservoir and Knoll Lake provide aquatic habitat, and some nesting habitat, though the steep sides of the reservoir and lack of tall wetland vegetation provide marginal nesting habitat. Only a few of the earthen tanks provide wetland vegetation such as common spikerush, smartweed, pondweed, and water plantain, and these are generally too small for nesting. They do provide stop-over habitat for waterfowl and wetland species such as avocets, greater yellow-legs, and long-billed curlews.

Management Indicator Species

[24]

Table 5 (below) displays the Management Indicator Species (MIS) by Management Area (MA) as defined by the Coconino National Forest Land Management Plan. The definitions of the MA's are listed in the footnote below the table.

Table 5 Management Indicator Species by Management Area⁷ within the Analysis Area

Management Indicator Species	MA3	MA4	MA5	MA6	MA7	MA9	MA12	M19	Forest Status
Turkey	X	X							stable
Northern Goshawk	X	X							stable
Pygmy Nuthatch	X	X							decline
Elk	X	X		X	X	X			stable
Abert's Squirrel	X	X		X					stable
Red Squirrel	X	X							stable
Hairy Woodpecker	X	X		X					stable
Mexican Spotted Owl	X	X							stable
Red-Naped Sapsucker			X						stable
Mule Deer			X	X	X				decline
Cinnamon Teal							X		stable
Macroinvertebrates							X		stable
Lincoln's Sparrow							X		*
Yellow breasted Chat							X		*
Lucy's Warbler							X		*
Pronghorn						X			*
Plain Titmouse					X		X		*
No Mgt Ind Species								X	

Table 5 The table lists the management indicator species (MIS) as indicated within the Coconino National Forest Plan for the respective management areas that occur within the East Clear Creek Watershed Health Analysis Area, as well as there population trend. The list of management areas follows directly below. * Note that MA7 and MA9 represent less than 0.1% of the project area and do not provide adequate habitat for two MIS, pronghorn and plain titmouse. In addition, the yellow-breasted chat and Lucy's warbler are MIS species for MA12, but are lower elevation riparian species, and are not found within the elevational range of the analysis area. Lincoln's sparrow is a very high elevation riparian species, and is not found within the lavational range of the analysis area. These five species are not considered MIS for this project.

⁷ **Management Area 3: Ponderosa Pine and Mixed Conifer with Less than 40% Slopes**

Management Area 4: Ponderosa Pine and Mixed Conifer with Greater than 40% Slopes

Management Area 5: Aspen

Management Area 6: Unproductive Timber

Management Area 7: Pinyon-Juniper Woodland with Less than 40% Slopes

Management Area 9: Mountain Grassland

Management Area 10: Grassland with Sparse Pinyon-Juniper

Management Area 12: Riparian and Open Water

Management Area 19: The Mogollon Rim

Declining populations of pygmy nuthatch and mule deer may indicate a need to change management direction on the Coconino National Forest. Declines in pygmy nuthatch were dramatic in the mid-1990's during drought conditions. Though populations have increased slightly in recent years, they have remained at levels well below those of the mid-1980's. Snags and yellow pines are critical habitat components for this species.

Mule deer populations are declining throughout the west. Management actions that promote increases in browse species may help to reverse this decline.

Federally Endangered Species

[23]

Southwestern willow flycatcher *Empidonax traillii extimus*: An obligate riparian nester, the southwestern willow flycatcher is found in the dense vegetation adjacent to streams, ponds, lakes, and springs. Vegetative species commonly present include boxelder, willows, ash, walnut, cottonwood, seep willow, button bush, cattails, Russian olive, and tamarisk. This species apparently prefers dense vegetation from the ground up to 20' high with standing water below or next to the vegetation. In higher elevation steams, vegetation may be limited to as few as two or three species of willow in dense thickets between 15 and 20 feet tall. Marginal potential habitat for this species exists along East Clear Creek. Biologists surveyed this habitat for flycatchers in 1993 and 1994. No birds responded to the taped calls. The floods of 1993 reduced the willow communities along the creek, and degraded the habitat for willow flycatchers.

Federally Threatened Species

[23,25]

Bald eagles *Haliaeetus leucocephalus*: Eagles are commonly found in the watershed during the winter months and during migration. They use clumps of large trees and snags on canyon slopes for roosts near the East Clear Creek drainage. They congregate around bodies of water, such as Blue Ridge and Knoll Lake Reservoirs, to forage on waterfowl and fish. They also fly over extensive areas searching for carrion and tend to frequent big game winter ranges in the pinyon-juniper woodland type. When winter storms occur, they move into the more protective ponderosa pine habitats. Key habitat components include the night-time roosts used during harsh weather and prey availability. Roosts are generally large yellow pines protected by slope position from inclement weather. Eagles were downlisted from endangered to threatened status by the U.S. Fish and Wildlife Service in 1995, and are currently proposed for de-listing (USFWS 1995, 1999). Eagles are seen frequently along State Highway 87 during the winter months, and throughout the watershed area. Potential roost locations are abundant along the slopes of the canyons, though no traditional roost sites have been identified. Eagles appear to opportunistically use roosts in response to food availability and weather conditions. Numbers of eagles counted on the District during winter surveys have been slowly increasing over the past 15 years.

Mexican spotted owl *Strix occidentalis lucida*: On the Coconino National Forest, the Mexican spotted owl occupies mixed conifer and ponderosa pine-Gambel oak vegetation types, usually characterized by high canopy closure, high stem density, multi-layered canopies within the stand, numerous snags, and downed woody material. Steep slopes and canyons with rocky cliffs characterize much of the suitable nesting/roosting owl habitat. Potential foraging habitat provides adequate cover and downed woody material or rocky outcroppings to offer foraging opportunities for the owls (Facts on the Mexican Spotted Owl, USDA Forest Service, September 1993).

The entire East Clear Creek watershed has been surveyed for owls and 21 territories have been delineated partially or wholly within the allotment. Mexican spotted owl Protected Activity Centers (PACs) makeup about 12,000 acres of the analysis area. Approximately 3300 acres of restricted habitat are designated as Target threshold habitat. An additional 8250 acres with steep slopes provide protected habitat, while another 7,650 acres fall into restricted habitat. The remaining 40,000 acres of the analysis area are covered with ponderosa pine forests, an unrestricted habitat type.

Little Colorado spinedace *Lepidomeda vittata*: This native fish occupies mid to upper water habitats of runs, pools, and swirling eddies, where it uses undercut banks, bedrock overhangs, and large boulders for cover. It is an opportunist, feeding on drifting aquatic and terrestrial insects, detritus, and filamentous green algae. Spawning occurs in spring and summer and may occur more than once a year. Threats to this fish include habitat degradation, impoundments, and the introduction of predators and competitive fish species.

The Little Colorado spinedace is found in East Clear Creek and Leonard Canyon, within and adjacent to the analysis area. Critical habitat is designated as the East Clear Creek drainage, from Potato Lake to the confluence with Leonard Canyon, excluding Blue Ridge Reservoir. The main tributaries draining into East Clear Creek (Barbershop Canyon, Yeager Canyon, Miller Canyon, Leonard Canyon, etc.) are thought to contain historic habitats for spinedace and provide potentially suitable habitat during wet years and high runoff. East Clear Creek above Blue Ridge Reservoir to the District boundary falls within the analysis area. Just below the dam, approximately 3 1/2 miles of the creek form part of the northern boundary of the analysis area. Leonard Canyon forms the east boundary. Six populations of spinedace have been observed within or adjacent to the analysis area in recent years.

A Recovery Plan for this species was finalized in January 1998. Concern over management activities is concentrated on maintaining water quality and quantity, streambank stability, and the condition of riparian vegetation. Guidelines used during 1998 AOP consultation also targeted the condition of headwater meadows.

In August 1998, the interdisciplinary team met to begin work on the range analysis for the analysis area. It became evident that a watershed assessment was necessary to define existing watershed conditions on the analysis area, and past and present impacts to the watershed and to the Little Colorado spinedace. An interagency team developed

the *East Clear Creek Watershed Strategy for the Little Colorado spinedace, and Other Riparian Species* (USFS 1999) to guide all management activities within the watershed, which includes the analysis area

Federally Proposed Species [23]

Chiricahua leopard frog *Rana chiricahuensis*: This frog was proposed for listing as a threatened species in 2000 (USDI, 2000). A few historic locations exist from East Clear Creek and Leonard Canyon. Arizona Game and Fish Department surveys conducted in 1992, 1993, 1994 and 1995 did not relocate this species in the watershed. The nearest intact population is located about 17 miles from the area. The distribution is discontinuous with populations in the northern part of the state confined to montane habitats of the Mogollon Rim. This population is separated from populations along the southern borders of Arizona and New Mexico. Statewide surveys indicate a severe decline in this species (Sredl 1993). East Clear Creek and several of the major tributaries provide historic habitat that is considered suitable habitat, with the exception of the presence of nonnative fish and crayfish. Most stock tanks in the watershed are devoid of riparian and aquatic vegetation, though a few are vegetated and provide potential habitat.

Sensitive Species [23]

In 1999, the Regional Forester's Sensitive Species List for Region 3 of the US Forest Service was updated to eliminate several species that were no longer considered sensitive, and to add species that were now considered sensitive due to habitat modification, impacts, or new information. The following discussion uses the new list of sensitive species.

Peregrine falcon *Falco peregrinus anatum*: The peregrine falcon typically inhabits open country to high mountains and open forested regions, preferably where there are rocky cliffs with ledges overlooking water, and an abundance of birds. In Arizona, water does not appear to be a necessary requirement, and cliffs overlooking forests are suitable nesting substrates. The US Fish and Wildlife Service proposed to delist the peregrine falcon, and published the Notice in the August 26, 1998 Federal Register (USDI 1998). The falcon was delisted on August 25, 1999.

These falcons were often seen along the cliff faces found along the Mogollon Rim, prior to 1990. The cliffs provide suitable nesting substrates in some areas. Much of the Rim area and 28,000 acres of potential foraging habitat on the Tonto Forest below the Rim, burned in the Dude Fire of 1990. No eyries have been located in the burned areas, however falcons are infrequently seen flying through the analysis area. An eyrie was located in the East Clear Creek drainage in 1998, approximately 3 ½ miles north of the project area. A second eyrie was located within the drainage in 2001, approximately 2

½ miles north of the project area. A third eyrie is located along the rim approximately four miles from the western boundary.

Management guidelines restrict activities within one mile of an active eyrie during the breeding season. Guidelines call for a seasonal restriction on construction within ½ mile of a nesting cliff during the breeding season (3/1 to 6/30). The two eyries in East Clear Creek are both over ½ mile from the project area and are not expected to be adversely affected by proposed activities.

Northern goshawks *Accipiter gentilis*: The northern goshawk nests in coniferous forests throughout the western United States. In Northern Arizona, goshawks nest in common montane habitats. Good nesting stands have at least 79% canopy closure, and marginal stands have a minimum of 60% closure (Reynolds, et al. 1991). In areas with a great deal of topographic relief, many of the nests are associated with drainages. The habitats with the highest potential for nests in the southwest are ponderosa pine and mixed conifer stands with large trees (>50.8 cm dbh) and densities of 61 large trees per hectare (Crocker-Bedford and Chaney 1988), generally, these are uncut forests and drainages.

The goshawk preys on large to medium sized birds and mammals. Many of these are ground nesters and foragers, and the downed wood component of the forest floor is important for food and cover. Small mammal populations in particular are regulated more by the abundance of the large downed woody material than by herbage production (Goodwin and Hungerford 1979, in AZ Game and Fish Dept. 1993). Understory vegetation does provide forage and cover for some prey species, and for the invertebrates on which they feed. There are eight known territories within the analysis area.

The Regional Forester signed the "Record of Decision for Amendment of Forest Plans - AZ and NM" on June 5, 1996, which provides specific management direction for the northern goshawk (and the Mexican spotted owl). This new policy applies to historical and active goshawk breeding home ranges in the southwestern region, and is based on recommendations by the Goshawk Scientific Committee and the Goshawk Task Force. Three components of its nesting home range are identified as nest area, post-fledgling family area (PFA), and foraging area (PA). These areas are managed for prey species, as well as to provide suitable habitat structures.

Eared Trogon *Euptilotis neoxenus*: This Mexican species is a transient on the Mogollon Rim. It breeds in southeastern Arizona where it is a rare species.

Little Colorado sucker *Catostomus* sp.: This fish lives in hard-bottomed habitats. Adults live in pools but move to riffles and runs to feed at night where they feed on the algae on stones. Young suckers live in the riffles during the day, feeding on midge larvae. As its name implies, this fish is found only in the Little Colorado River basin, which includes East Clear Creek. Little is known about the species or its habitat. It apparently likes pools with abundant cover, spawns in the spring, and the young move

into slow moving riffles. It has not yet been described as a species, and has been found in the East Clear Creek watershed.

Roundtail chub *Gila robusta*: This fish tends to occupy pools and eddies, often concentrating in relatively swift, swirling waters below rapids, and moving into smooth flowing chutes in small groups, presumably to feed on drifting materials. Cover such as boulders, tree rootwads, submerged trees and branches, and cut-banks is usually present. Food consists of aquatic and terrestrial insects, filamentous algae, and when large, other fishes. Young move into quiet backwaters until they reach 25 to 50 millimeters in length, where they feed on small insects, crustaceans, and algal films. Introduced fish seem to affect this fish's population. Breeding occurs in spring and early summer, presumably in pools. Recent reports indicate that it is located in East Clear Creek, downstream of the analysis area.

Northern Leopard Frog *Rana pipiens*: Leopard frogs are highly aquatic frogs and are almost always associated with permanent water. They are strong jumpers and able swimmers. They consume a variety of insects and other aquatic invertebrates and prefer areas with profuse aquatic vegetation. In surveys for the Coconino National Forest, M. Sredl (1992) describes habitat for northern leopard frogs as lakes, springs, stock tanks, streams and rivers.

There are historical records for northern leopard frogs at six locations within the East Clear Creek watershed. Biologists with AZ Game and Fish Department (AGFD) surveyed these and many other sites in 1992 and 1993. They were unable to find frogs, eggs, or metamorph of this species at any of the surveyed sites. Field crews checked some stock tanks with aquatic vegetation during the summer of 1992. No leopard frogs were located and most tanks were devoid of vegetation around the perimeter of the pools. Sredl (1993) reports that statewide surveys indicate severe declines in northern leopard frogs.

Arizona Southwestern Toad *Bufo microscaphus microscaphus*: The Arizona Southwestern toad occurs in rocky streams, canyons, and floodplains with usually dense riparian vegetation. Found in the upland desert and pine/oak communities south of the Mogollon Rim between 2,000 and 6,000 feet in elevation. They breed in gently flowing waters generally with well-developed riparian vegetation. This toad feeds on insects and snails. Generally, they occupy habitat similar to that of leopard frogs. There is one record of Arizona toads from East Clear Creek, which is above the described elevation range.

Narrow-headed gartersnake *Thamnophis rufipunctatus*: This snake prefers quiet, rocky pools along permanent streams cutting through pinyon-juniper and oak woodlands into ponderosa pine forest. Broadleaf riparian trees such as cottonwoods, willows and ashes often provide broken shade. It is the most aquatic garter snake found in Arizona and is often found in deep pools. Historically it was found on the Mogollon Rim and was likely an inhabitant of the East Clear Creek area. There are no recent records from the area.

Mountain Silverspot Butterfly *Speyeria nokomis nitocris*: The mountain silverspot butterfly occurs along the Mogollon Rim, Mogollon Mountains, White Mountains, and into northern New Mexico (Ferris and Brown 1981). The species as a whole uses moist meadows, seeps, marshes, and streamsides. Caterpillar hosts are violets. Adult food is flower nectar, including that from thistles. Females lay single eggs on the ground near host plants. This species is not known to occur in the watershed. Suitable habitat for this butterfly may occur in the upper elevations of the analysis area. No surveys have been conducted.

Tiger Beetle *Cicindela hirtocollis corpuscular*: Little information is known of this species. It is a species of tiger beetle that occurs in the Colorado River system in a number of counties in Arizona (Coconino, Graham, Greenlee, Maricopa, Navajo, and Yuma). It is probably tied to perennial or intermittent streams. Adults are present from April to November on sandy banks of rivers and streams. This species is not known to occur in the watershed. Suitable habitat occurs along East Clear Creek and its tributaries. No surveys have been conducted.

Maricopa Tiger Beetle *Cicindela oregona*: Habitat for the Maricopa tiger beetle is always in sandy, riparian situations and includes open sand or mud flats, stone terraces along permanent or intermittent streams, and areas near temporary and permanent ponds. They have been found near leaky faucets and pipes, cattle tanks and ponds, and along streams red with mine waste. Vegetation characteristics include riparian corridors of ash, sycamore, cottonwood, and willow, but this may vary from juniper-chaparral to grassland and upper Sonoran desert scrub. They generally occur at elevations ranging from 1,092 to 6,880 feet. This species is fairly widespread and is known to occur on the Long Valley Ranger District and along the Verde River, Oak Creek, and Beaver Creek. It is also known from the Mogollon Rim along Pine Creek, but not in this watershed. Suitable habitat exists in riparian drainages, as well as near stock ponds and springs. No surveys have been conducted.

Blue-black Silverspot Butterfly *Speyeria nokomis nokomis*: The blue-black silverspot butterfly has a global range that is very local in Arizona and New Mexico, where it has been extirpated from most of its known sites. It is generally found in streamside meadows and seepage areas with an abundance of violets, generally in desert landscapes. The species uses moist meadows, seeps, marshes, and streamsides. Caterpillar hosts are violets. Adult food is flower nectar, including that from thistles. Females lay single eggs on the ground near host plants. This species has not been documented on the analysis area. Suitable habitat for this species may occur along the East Clear Creek and in wet meadows of the headwaters. No surveys have been conducted.

Early Elfin *Incisalia fotis*: The early elfin favors roadsides with flowers and dry areas in mountains. Larva feed on cliffrose. The species is locally uncommon among arid plateaus and desert mountains from 6,000 to 7,000 feet elevation. They may be restricted to the northern portions of Coconino County, and may be unlikely to occur on

the Coconino National Forest. This species has not been documented on the analysis area. Suitable habitat may occur in the northeastern portion of the analysis **area where cliffrose is present. No surveys have been conducted.**

Spotted Skipperling *Piruna polingii*: The spotted skipperling is limited to a relatively few mountain ranges within Arizona, New Mexico, and Mexico. In Arizona, it occurs in the Huachucas, Chiricahuas, and along the Mogollon Rim. It is noted as absent from many apparently suitable areas, but is commonly found in others. Habitat generally consists of moist meadows and streamsides in low to mid elevation mountains. This species is not known to occur on the analysis area. Suitable habitat for the spotted skipperling may occur along East Clear Creek and its tributaries. No surveys have been conducted.

The Effects of Alternative A on Wildlife

This effects discussion will be a summary of two specialists reports, the general wildlife specialists report [99,107] and the fisheries specialists report [76, 105]. The complete discussion of effects to species can be found in those documents. For Alternative A, there will be little direct effect to the current species that occur within the analysis area. The species of most concern within this analysis area is the Little Colorado spinedace. Under this alternative, the environmental baseline for the species will continue to stay the same for the direct effect.

The indirect effect of the implementation of this alternative is that the combination of degraded channel conditions in meadows, road and recreation impacts will continue, and the increased fuel loading will continue to increase the risk of stand replacing fires that could all have a negative impact to the spinedace, as well as other aquatic dependent species [99,107].

Big game species will display little direct or indirect effects from this alternative. The management indicator species (MIS) associated with management areas (MA's) 3, 4, and 6 will have little direct effect from the alternative, but may have a negative indirect effect in the long-run due to the increased risk of stand-replacing fires. There is no direct effect to the MA 5 indicator species, however, there could be a positive indirect effect to MA 5 species through an increase in habitat if stand-replacing fires did occur.

The direct and indirect effects to MIS species in MA 12 would be similar to the effects for spinedace discussed above. The insect species that favor riparian habitats will not have a direct effect from this alternative, but habitat will be lost over time through degraded meadow and riparian conditions [99,107].

Effects to Threatened, Endangered and Sensitive (TES) species are similar to those listed above for the management indicator species. The avian TES species that are not associated with riparian habitats will not have a direct effect from the no action, however, all face an indirect habitat affect from the increased potential of stand-replacing fire [99,107]. The aquatic dependent TES species all have the same direct

and indirect effects as those that were discussed for the Little Colorado spinedace. At the end of the wildlife section there are several tables that summarize habitat effects from all of the alternatives. Table 6 summarizes the overall effect to aquatic dependent species and habitat components for all of the alternatives, while Table 7 summarizes the effects to non-TES species. Table 8 summarizes the effects to Mexican spotted owl habitat components from the given alternatives.

Effects Of Alternatives B And C On Wildlife

This effects discussion will be a summary of two specialist's reports, the general wildlife specialists report [99,107] and the fisheries specialist's report [76,105]. The complete discussion of effects to species can be found in those documents.

Aquatic species (Little Colorado spinedace, bluehead sucker, roundtail chub, Little Colorado sucker, narrow-headed garter snake, Arizona southwestern toad, northern leopard frog, macroinvertebrates and the Chiricahua leopard frog) may have direct, negative impacts from the prescribed burning through the potential for increased sediment and ash to be delivered to streams. These short-term negative effects are mitigated through BMP's #'s 1,2, and 3 as outlined in chapter 2, table 4 of this EA. Alternative B will have less acres disturbed, therefore it will have less negative short-term, direct effects associated with it than Alternative C.

The same aquatic dependent species listed above, as well as species dependent of riparian habitats (southwestern willow flycatcher, mountain silverspot butterfly, tiger beetle, blue-black silverspot butterfly, and spotted skipperling) will have potential short-term negative effects from channel shaping activities at Houston Draw, Lockwood Draw, Kinder Draw and Dick Hart Draw; the 7 miles of roadbed removal work; the road maintenance work; the raised culverts at Dick Hart Draw, 321C road, and Holder Cabin; the trail obliteration and construction (in alternative C) and the road obliteration (in alternative C) through site disturbance on-site and potentially downstream from the activities. The on-site and downstream effects will be mitigated through BMP's # 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 29 and 21 listed in Chapter 2, Table 4. There will be disturbance on-site at each activity that will effect the movement of elk, deer, turkey, Abert's squirrel, , and red squirrel, but this will be limited to when the activity is occurring.

For indirect, long-term benefits, the action alternatives improve soil and water conditions, which will in turn improve habitat conditions for most all of the species within the analysis area [99,107]. The species of most concern within this analysis area is the Little Colorado spinedace. Under the action alternatives, the environmental baseline for the species will be improved over time, with Alternative C providing the most improved conditions. Alternative C will achieve this improvement through a larger reduction of the fire risk component through prescribed burns and precommercial thinning, as well as the reduction of recreation impacts at a known population at Dines Tank, and the recreation impact work in the 321C area and at Holder Cabin meadow. In addition, channel restoration work, removal of previously obliterated roads beds and re-shaping

of 7 miles of non-riparian channels, road obliteration (in alternative C), ponded wetland creation on roads, trail work at General Springs, meadow restoration through thinning of >12"dbh trees, and thinning around springs will also improve habitat conditions in the long-run. There will be some potential short-term negative effects due to ground disturbance and these will be mitigated through BMP's (see above discussion of direct effects). Table 6 displays the effects of individual proposed activities on the spinedace and other aquatic dependent species

**Table 6 : Summary of Watershed Health Effects
On Little Colorado spinedace and aquatic dependent species and their Habitat**

Activity	Spinedace Habitat	General Fish/Aquatic Habitat
No Watershed Health Actions	Negative – Indirect Effect Targeted stream channels will continue to contribute potentially high amounts of sediment to stocking sites Sediment and ash flows, and potential debris torrents from stand replacing fire could eliminate stocked spinedace and/or stocking sites.	Negative – Indirect Effect Targeted stream channels will continue to contribute potentially high amounts of sediment with potential of embedding channel substrates causing reduction in fish spawning and aquatic insect habitats. Lack of burning will continue threat of large, uncontrolled sediment and ash flow to drainages from stand replacing fire.
Prescribed Burning	Negative – Indirect Effect (short-term) Potential for transport and/or loading of silt and ash within potential stock sites: Dane, Yeager, General Springs, & Houston Draw. Positive - Indirect Effect (long-term) Reduced risk of catastrophic fire effects	Negative – Indirect Effect (short-term) Potential for transport and/or loading of silt and ash within associated stream channels. Positive - Indirect Effect (long-term) Reduced risk of high amounts of silt and ash loading to stream channel rendering water quality and embedded substrates uninhabitable.
Precommercial Thinning	Little to no accountable effect. Very slight possibility for supplemental ground water storage and release into Miller Cyn and General Springs Canyon from reduced canopy treatment in largest thinning block on Battleground Ridge. Drainages may experience increased flows during snowmelt.	Little to no accountable effect. Very slight possibility for supplemental ground water storage and release into Miller Cyn and General Springs Canyon from reduced canopy treatment in largest thinning block on Battleground Ridge. Drainages may experience increased flows during snowmelt
Removal of Tanks in Upper Barbershop, Dick Hart, Ronny's and Kinder Tank.	No direct effect	Short-term negative effect from pulse of project induced sediment transported through respective drainages and habitat disturbance on-site for frog species (if present) Long-term positive effect from reduction in contributed sediment loading and transport through respective drainages, as well as return to a more natural hydrograph
Install Headcut drop structures at General Springs, Houston Draw and Lockwood Draw.	Depending on timing of installation, may have short-term negative effect on spinedace stocking sites in General Springs Cyn & Houston Draw. Long-term positive effect from reduced contribution of sediment from treated headcuts.	Short-term negative effect from pulse of project induced sediment transported through respective drainages. Long-term positive effect from reduction in contributed sediment loading and transport through respective drainages
Lay back banks and revegetate with native vegetation for 3 miles in Houston, Lockwood, Kinder and Dick Hart Draws.	Depending on timing of installation, may have short-term negative effect on previously stocked spinedace in Houston Draw. Long-term positive effect from reduced contribution of sediment from treated banks.	Short-term negative effect from pulse of project induced sediment transported through respective drainages. Long-term positive effect from reduction in contributed sediment loading and transport through respective drainages
Raise culvert on FR 95 to create ponded wetland.	No effect	Short-term negative effect from pulse or project induced sediment. Possible increase in pool habitat down drainage should substantial ponding occur above treated site.

Chapter 3 Affected Environment and Environmental Consequences
East Clear Creek Watershed Health Environmental Assessment

Activity	Spinedace Habitat	General Fish/Aquatic Habitat
Rehabilitate or remove wood structures in Buck Springs and Houston Draws.	Depending on timing of rehab work, may have short-term negative effect from project generated sediment potential stocking sites in Buck Springs & on a stocking site in Houston Draw. Long-term positive effect from reduced contribution of sediment from treated channel cutting.	Short-term negative effect from pulse of project induced sediment transported through respective drainages. Long-term positive effect from reduction in contributed sediment loading and transport through respective drainages.
Maintain the weir at Buck Springs.	Depending on timing of rehab work, may have short-term negative effect from project generated sediment on potential stocking sites in Buck Springs. Long-term positive effect from reduced contribution of sediment from treated area around the weir.	Short-term negative effect from pulse of project induced sediment transported through respective drainages. Long-term positive effect from reduction in contributed sediment loading and transport through respective drainages from existing source areas.
Remove roadbed and return natural flow regime in 7 miles of non-riparian drainages.	No effect on-site.	Short-term negative effect from pulse of project induced sediment transported through respective drainages. Long-term positive effect from reduction in contributed sediment loading and transport through respective drainages from existing source areas. Improvement in timing and duration of flows through re-establishment of natural contours—return to a more ‘natural’ hydrograph.
Meadow restoration through thinning conifers	Improvement in meadow habitat may help to improve PFC in Buck Springs, Holder, General Springs, Houston and Merritt Draws. Drainages may experience increased flows during snowmelt.	Improvement in meadow habitat may improve PFC. Drainages may experience increased flows during snowmelt
Stabilize stream crossings on 28 roads for a total of 2 miles.	No effect on-site. Long-term positive effect from reduced contribution of sediment from treated road crossings.	Short-term negative effect from pulse of project induced sediment transported through respective drainages. Long-term positive effect from reduction in contributed sediment loading and transport through respective drainages from existing source areas.
Trail construction/obliteration at General Springs	Short-term negative effect from project generated sediment transport into General Springs Canyon. Long-term positive effects in reduced sediment transport and loading within the stream channels of potential future stocking sites in General Springs Canyon.	Short-term negative effect from pulse of project induced sediment transported through respective drainages. Long-term positive effect from reduction in contributed sediment loading and transport through respective drainages from existing source areas.
Treatments on 321C road to minimize damage to meadow system from vehicles.	Possibility of short-term negative effect from project generated sediment transport through system is so very slight. Possibility for long-term positive effects in reduced sediment transport and slight increase in downstream water yield to future stocking site in Dane Canyon.	Short-term negative effect from pulse of project induced sediment transported through respective drainages. Long-term positive effect from reduction in contributed sediment loading and transport through respective drainages from existing source areas. Possible increase in pool habitat from ponded wetlands.
Treatment on 643A road/Holder Cabin area to minimize impacts to meadow and drainage from vehicles.	Possibility of short-term negative effect from project generated sediment transport through system is so very slight. Possibility for long-term positive effects in reduced sediment transport and slight increase in downstream water yield to future stocking site in Yeager Canyon.	Short-term negative effect from pulse of project induced sediment transported through respective drainages. Long-term positive effect from reduction in contributed sediment loading and transport through respective drainages from existing source areas.

Activity	Spinedace Habitat	General Fish/Aquatic Habitat
Energy dissipater installation on 95 and 96 roads.	Short-term negative effect from project generated sediment transport through drainages. Long-term positive effects in reduced sediment transport and loading within the stream channels of the future stocking sites in Yeager Cyn and Houston Draw.	Short-term negative effect from pulse of project induced sediment transported through respective drainages. Long-term positive effect from reduction in contributed sediment loading and transport through respective drainages from existing source areas.
40 acres area closure at Dane Springs and 15 acres closure at Dines tank to minimize impacts from vehicles.	Short-term negative effect from project generated sediment transport through Dane Canyon and Dines Tank. Long-term positive effects in reduced sediment transport and loading within the stream channels of the future stocking sites in Dane Canyon. Long-term protection of known spinedace location at Dines Tank.	Short-term negative effect from pulse of project induced sediment transported through respective drainages. Long-term positive effect from reduction in contributed sediment loading and transport through respective drainages from existing source areas.

Table 6: Table of effects of Little Colorado spinedace and associated aquatic species and their habitat [76,99,105,107]. The table displays descriptions of expected effects from proposed projects to potential spinedace stocking sites as well as general fish/aquatic habitat. Other aquatic species include the following species (Little Colorado spinedace, bluehead sucker, roundtail chub, Little Colorado sucker, narrow-headed garter snake, arizona southwestern toad, northern leopard frog, macroinvertebrates and the Chiricahua leopard frog)

Elk habitat will improve through the implementation of prescribed fire from the action alternatives. The prescribed burns will improve browse and grass species, give nutrient flushes to existing plants and make them more palatable and nutritious. Mule deer will likely benefit from increases in browse species as a result of thinning and burning.

Abert's squirrel (MIS species for MA's 3,4, and 6) habitat may see a positive effect from the activities that will fell trees less than 12 inches, as long as basal area of the overstory is not reduced below 80 sq. ft. (precommercial thinning, spring rejuvenation cutting, and thinning at recreation sites on the 321C road) through an increase in fungi growth in alternative C,. There may be a short-term negative effect to fungi populations with the prescribed burning alternatives, but this will be minimized over time (Patton 1977). This of course is dependent on the fire intensity within the prescribed burn areas. The higher the burn intensity, the greater the impact and the longer the recovery time will be for fungi. All other treatments will not affect the Abert's squirrel [99,107].

The effects to the pygmy nuthatch and hairy woodpecker will come primarily from the prescribed burn alternatives, which may reduce the availability of snags through the burning of snags, but it may also create new snags through the killing of live trees [99,107]. Thus, Alternative C may have the biggest effect to these species, but it is not expected to be detrimental due to mitigation efforts (see Chapter 2, Table 4, w2). The red-naped sapsucker is a primary cavity nester that occurs in aspen snags, and the only activity that may affect this species is the prescribed burning. The burning of snags would have the same effects for the pygmy nuthatch and the hairy woodpecker. Snags will be protected in all prescribed burns, thus this potential effect is mitigated.

Macroinvertebrates will show short-term disturbance from in-channel restoration efforts, but as habitats improve, so will macroinvertebrates populations [99,107].

The effects to Mexican spotted owl (an MIS species) will be discussed below. Turkey habitat should improve with improvements in meadow conditions, but will display a similar short-term, negative effect due to the ground disturbing activities. Effects to red squirrel are not anticipated from any of the proposed actions because the actions are proposed in areas that this species does not occupy [99,107].

Threatened, Endangered, and Sensitive (TES) species will display some effects from proposed activities within alternatives B and C. There will be burning within protected and restricted habitat for the Mexican spotted owl, but no direct effect to nesting and roosting activity within PACs (Protected Activity Centers) because there will be no burning within PACs[99,107]. The actions within the protected and restricted habitat (see table 8 for a summary of acres affected) may create a short-term reduction in prey species abundance due to a loss of down woody material and a potential loss of snags. However, this loss of habitat is often times offset by an increase in prey availability through increased visibility to the forest floor, so the net effects to prey for the Mexican spotted owl (as well as the northern goshawk and peregrine falcon), should be about the same as pre-burning. Microhabitat monitoring will be done prior to burning and thinning in MSO restricted habitat (mitigation id# 1)

The indirect effects to Mexican spotted owl habitat is a decreased risk of large, stand replacing fires, improved habitat conditions through improved amounts of herbaceous and seed-bearing plants post fire, and protection around PACs through a reduction of fire-risk [99,107]. There will be some habitat manipulation through burning activities, however, these will improve overall habitat conditions. Alternative C will display the greatest long-term improvement in habitat for the Mexican spotted owl. Projects within alternatives B and C that are designed as watershed restoration activities do not have a direct effect to owl habitat. There is an indirect effect to owls through changes in prey habitat that will occur over time. The proposed watershed improvement projects will improve meadow conditions, and this should improve the habitat for voles.

Burning and precommercial thinning would occur on the ridgetops, and would have no impacts to potential southwestern willow flycatcher (SWWF) habitat. A reduction of stand-replacing wildfire risk will improve long-term habitats downstream through a potential reduction of sediments and high peak flows directly after a large wildfire. In general, the watershed projects (channel restoration; meadow improvement through tree removal; road maintenance at stream crossings; reshaping channels with previously obliterated roads; recreation impact minimization at Dane Springs, Dines Tank, Holder Cabin meadow, General Springs and the 321C road complex; spring rejuvenation cutting, tank removal; and raised culverts) are expected to improve watershed conditions on the analysis area and to improve riparian vegetation. None of the projects would occur within potential SWWF habitat, so there would be no direct effects to habitat. There are some short-term sediment concerns from the construction of the projects, but these are being minimized through the application of BMP #s 5, 6,7,

8, 9, 10, 11, 12, 13, 14, 29 and 21 listed in Chapter 2, Table 4. All projects are designed to move riparian conditions toward proper functioning conditions, reduce sediment into streams, improve the sponge effect in meadows, and create additional wetlands. Overall, these projects are expected to move potential habitat towards suitability for the SWWF [99,107].

The effects to Bald Eagles are primarily a reduction of stand-replacing fire risk, which will maintain habitat components for the eagle. Precommercial thinning projects would occur on ridgetops in the understory thickets of sapling pines. They would have no impact on roost trees or bald eagle habitat and would not affect the food resources of eagles. Other watershed restoration projects would have no effects to bald eagles or their habitats. All of the projects that take place in drainages would not affect large trees that provide night roosts or day perches [99,107].

There are eight known goshawk territories on the analysis area, and potential nesting habitat exists for additional pairs. Burning projects are proposed for 550 acres within two goshawk PFAs in Alternative B, and for 900 acres in Alternative C. Thinning projects would occur in the foraging areas for goshawks, but not in the nest stands or PFAs. The effects to the Northern goshawk are similar to the effects to the Mexican spotted owl. Prey distribution will be changed by prescribed fire activities, but overall should be about the same as pre-burn conditions. Existing nesting areas are not proposed for treatment, so would not directly impact goshawks. Fires near nesting areas in early spring before fledging may result in mortality of juveniles. To mitigate this, burns adjacent to nest stands would occur outside the breeding season. Other watershed restoration projects would have no effects to northern goshawks, or their habitats on the analysis area. All projects take place in drainages, and would not affect large trees that provide perches, roosts or potential nest sites. Prey habitat is likely to improve, as riparian habitats improve for birds. Indirect effects to the goshawk are an improvement in long-term sustainability of habitat through a reduction of fire risk throughout the analysis area [99,107].

The aquatic dependent TES species all have the same direct and indirect effects as those that were discussed for the Little Colorado spinedace—these are discussed in Table 6 above. The TES insect species that are associated with riparian habitats (spotted skipperling, blue-black silverspot butterfly, Maricopa Tiger Beetle, Tiger Beetle, and mountain silverspot butterfly) will be affected directly through habitat disturbance. Construction activities will remove vegetation for a short time period, which will affect habitats negatively. Best management practices designed to re-vegetate ground-disturbed areas will move the site to habitat suitability in 2-3 years after the project, with an overall increase in the amount of suitable habitat. The projects where these effects could occur include channel restoration; meadow improvement through tree removal; road maintenance at stream crossings; reshaping channels with previously obliterated roads; recreation impact minimization at Dane Springs, Dines Tank, Holder Cabin meadow, General Springs and the 321C road complex; spring rejuvenation cutting, tank removal; raised culverts; and road obliteration (alternative C only).

Habitat for the Chiricahua Leopard Frog could be negatively impacted in the short-term through the removal of tanks in Barbershop and the maintenance work on existing structures in Buck Springs. As the site recovers from the project, the habitat will improve in overall suitability. The tank removal in Kinder Draw will remove this small piece of potential habitat for the Chiricahua Leopard frog. The tanks in Dick Hart Draw (as part of channel restoration efforts) currently are breached and do not hold water, thus there will not be an effect to the leopard frog from the tank removal action in Dick Hart Draw. All stock tanks slated for removal will be surveyed for the presence of the Chiricahua Leopard frog before construction activities occur. If the sites are occupied, the agency would propose additional mitigation measures and re-initiate consultation with US Fish and Wildlife Service.

Cumulative Effects

There are several cumulative and on-going activities that are occurring that affect wildlife species within the analysis area. Past grazing by domestic and wild ungulates has affected habitat components greatly. Heavy livestock grazing (sheep and cattle) at the turn of the century has created many of the conditions that occur within the analysis area. Large numbers of grazing animals denuded meadow areas of vegetation that stabilized the meadow systems (willows, sedge, rush, spikerush). This led to channel cutting events that lowered water tables within the meadow systems and increased the efficiency of water moving through the system. Past fire management practices have also affected the conditions within the analysis area. Fire suppression has increased fuel loadings throughout the area. Some of this has been negated by past timber sale activities and the corresponding post-sales fuels reduction (pile and burning of activities fuels). Timber sales also roaded the analysis area, which are having affects to the watershed and correspondingly the wildlife. Recreation use will continue to increase, thus the cumulative impacts from recreation will increase. On-going domestic livestock use and wild ungulate grazing is also a cumulative impact to wildlife. The control of permitted cattle grazing impacts will also be key to attaining the displayed effects to wildlife species. A parallel analysis of the permitted cattle grazing within the analysis area is occurring with the analysis area Environmental Impact Statement.

Grazing by wild ungulates, and in particular, by elk, will have the greatest impact to the success of the proposed actions. In particular, large amounts of grazing by elk in meadow systems may negate revegetation efforts of disturbed sites. Best Management Practices # 6 and # 7 discuss protection measures for revegetation efforts and will be key for successful site restoration. Efforts by the Arizona Game and Fish Department to reduce herd size in the East Clear Creek watershed will also be key to successful site restoration. As with the soils cumulative effects discussion, roads, recreation, and past fire exclusion are also cumulative impacts to wildlife.

Actions within the watershed that also affect wildlife species include the Victorine Wildland Urban Interface Project and the Blue Ridge Wildland Urban Interface Project. These actions are also reducing fire risk through prescribed burn and thinning

treatments. These actions have similar effects to all of the species discussed above and will improve habitat conditions over time.

Roads impact wildlife in a variety of ways, from disturbance to acting as sediment delivery systems. The proposed road work within this project does not greatly reduce the open road density within the analysis area, and as such, there will probably be little impact from the proposed road treatments in Alternatives B and C that will minimize disturbance to wildlife. However, both Alternatives B and C will reduce the amount of sediment production and minimize the impacts to peak flows from roads within the analysis area only. On a watershed scale, these treatments are not complete, but will reduce sediment impacts and will improve habitat conditions for aquatic dependent species in the long-run.

Recreation impacts to meadows are reduced in each of the Alternatives, but will not be completely solved. The Arizona OHV Forest Plan Amendment - For Apache-Sitgreaves, Coconino, Kaibab, Prescott, and Tonto National Forests progress may limit off-road use, which may minimize recreation impacts to meadows. Alternative C provides a larger improvement in meadow conditions through the thinning of encroaching trees within 300 acres of meadows. The slash left on-site will also protect the site from elk grazing, therefore, this treatment has a great potential to minimize the cumulative impact of elk grazing at the sites where slash is left on-site in the meadows.

Much like the soil resources, Alternative C will provide the greatest benefit to wildlife resources in the long-term, but will also provide the greatest potential short-term direct impacts from construction and fire activities. Alternative A has the no direct impact to wildlife resources from construction or burning activities, but maintains poor soil conditions and excessive erosion from headcuts and vertical banks that will degrade habitats, especially for aquatic species. Alternative A also has the greatest potential for a large stand replacing fire, which would be an indirect negative effect to most wildlife resources. The effects of Alternative B lie between Alternative A and C. Overall, Alternatives B and C begin to address

**Table 6 : Summary of Watershed Health Effects
Non TES Species**

Measure Activity/ Treatment	Alt A summary	Alt B summary	Alt C summary	Effects on fuel buildups	Effects meadows	Effects on sediment	Effects on Habitat Components
No Watershed Health Actions	0 acres 0 treatments	N/A (see below)	N/A (see below)	Fuels will continue to build-up, decreasing fire dependent browse species. Indirect effect to habitat loss for aquatic species from ash flow through increased potential for stand-replacing fires. Potential long-term indirect benefit to habitat from large woody debris entering streams after stand-replacing fires.	Meadow habitat still compacted and with low vegetative diversity. Indirect effect due to long-term change from meadow to tree site. If trees occupy sites, will change habitat and decrease unique meadow habitat in a forested community.	Sedimentation continues or increases over time, negatively affecting riparian habitats for amphibians, reptiles, or small mammals associated with riparian vegetation. Sediments would continue from General Springs trail.	Increase acres of cover over time (indirect effect). Snag populations not affected, with potential indirect effect of increasing snag number over time. Decreased biodiversity as canopies close. Indirect effect of increasing potential of large stand-replacing fire.
Prescribed Burning	0 acres	10,000 acres	19,700 acres	Direct reduction of fuels build-up. Over time (approximately 10 years after last burn) fuels will build up again	No direct effect, indirect effect of reduction of potential stand replacing fires will minimize potential large stream flow events through meadows	Minimal direct effect from off-site sediment movement with low intensity fires. As fire intensity increases, increased sediment effects can occur which can be detrimental to spawning beds.	Direct effect to hiding cover would be minimal, indirect effect of improved structural diversity and increased grass and forbs production. Minimal indirect affect to fish habitat based on low intensity burn prescriptions and filter strips.
Precommercial Thinning	0 acres	0 acres	9,200 acres	Direct increase in fuel buildups post thinning until site is prescribed burned after treatment.	No direct effect, indirect effect of reduction of potential stand replacing fires will minimize potential large stream flow events through meadows	No direct effect. Potential positive indirect effect through reduction of fire-risk	In alt C, conversion of 35 acres of combo cover to thermal cover, reduction of hiding cover by 55 acres. potential indirect effect of increasing snag number over time. Some disturbance during project implementation

Chapter 3 Affected Environment and Environmental Consequences
East Clear Creek Watershed Health Environmental Assessment

Measure Activity/ Treatment	Alt A summary	Alt B summary	Alt C summary	Effects on fuel buildups	Effects meadows	Effects on sediment	Effects on Habitat Components
							Improvement in biodiversity over time through canopy opening. This effect will diminish over time as canopies begin to close 10-20 years after thinning.
Removal of Tanks in Upper Barbershop, Dick Hart, Ronny's and Kinder Tank.	0 acres	5 tanks	7 tanks	No direct effect from this action. Possible long-term indirect effect could have an increase in fuel loading if meadow condition improves enough to have bunchgrass dominated communities rather than Kentucky Bluegrass communities.	Direct negative effect through ground-disturbing activity, indirect long-term positive effect due to decreased usage of vegetation (sacrifice area around tanks are removed), indirect long-term positive effect to how water moves through the system.	Short-term increase in sediment production through ground disturbance, long term improvement through improvement meadow condition. Will improve habitat conditions for mammals, birds and aquatic species.	Short-term direct effect (negative) to habitat for associated aquatic species through ground disturbance and vegetation removal. Indirect positive effect to improve riparian conditions through the change in how water moves through the system. Will improve habitat conditions for mammals, birds and aquatic species over time.

Chapter 3 Affected Environment and Environmental Consequences
East Clear Creek Watershed Health Environmental Assessment

Measure Activity/ Treatment	Alt A summary	Alt B summary	Alt C summary	Effects on fuel buildups	Effects meadows	Effects on sediment	Effects on Habitat Components
Natural Channel Design and/or Install Headcut drop structures at General Springs, Houston Draw and Lockwood Draw.	0 miles	12 structures or 3 miles	12 structures or 3 miles	No direct effect from this action. Possible long-term indirect effect could have an increase in fuel loading if meadow condition improves enough to have bunchgrass dominated communities rather than Kentucky Bluegrass communities.	Direct negative effect through ground-disturbing activity, indirect long-term positive effect due to improved water movement through the system (energy dissipated rather than through gullies). Improved PFC over time. Will improve habitat conditions for mammals, birds and aquatic species.	Short-term increase is sediment production through ground disturbance, long term improvement through removal of vertical banks and headcuts. Will improve habitat conditions for mammals, birds and aquatic species.	Short-term direct effect (negative) to habitat through ground disturbance and vegetation removal, especially to aquatic and riparian-dependent species. Some potential short term flush of sediments could negatively effect aquatic species downstream of the project area. Indirect positive effect to improve riparian conditions through the change in how water moves through the system and decrease in vertical banks and headcuts. Improved timing of water will decrease peak flows and sustain duration of flows on-site and off-site. Over time, habitat conditions for aquatic and riparian dependent species will improve. Will not have a direct effect for cavity nesting species, but will improve insect habitat over time for feeding opportunities. Will re-locate elk and deer while site protection measures are in place (8' fence).

Chapter 3 Affected Environment and Environmental Consequences
East Clear Creek Watershed Health Environmental Assessment

Measure Activity/ Treatment	Alt A summary	Alt B summary	Alt C summary	Effects on fuel buildups	Effects meadows	Effects on sediment	Effects on Habitat Components
Lay back banks and revegetate with native vegetation in Houston, Lockwood, Kinder and Dick Hart Draws.	0 miles	3 miles	3 miles	No direct effect from this action. Possible long-term indirect effect could have an increase in fuel loading if meadow condition improves enough to have bunchgrass dominated communities rather than Kentucky Bluegrass communities.	Direct negative effect through ground-disturbing activity, indirect long-term positive effect due to improved water movement through the system (energy dissipated rather than through gullies). Improved PFC over time. Will improve habitat conditions for mammals, birds and aquatic species.	Short-term increase in sediment production through ground disturbance, long term improvement through removal of vertical banks and headcuts. Will improve habitat conditions for mammals, birds and aquatic species.	Short-term direct effect (negative) to habitat through ground disturbance and vegetation removal, especially to aquatic and riparian-dependent species. Some potential short term flush of sediments could negatively effect aquatic species downstream of the project area. Indirect positive effect to improve riparian conditions through the change in how water moves through the system and decrease in vertical banks and headcuts. Improved timing of water will decrease peak flows and sustain duration of flows on-site and off-site. Over time, habitat conditions for aquatic and riparian dependent species will improve. Will not have a direct effect for cavity nesting species, but will improve insect habitat over time for feeding opportunities. Will re-locate elk and deer while site protection measures are in place (8' fence).

Chapter 3 Affected Environment and Environmental Consequences
East Clear Creek Watershed Health Environmental Assessment

Measure Activity/ Treatment	Alt A summary	Alt B summary	Alt C summary	Effects on fuel buildups	Effects meadows	Effects on sediment	Effects on Habitat Components
Raise culverts to create ponded wetland.	0 culverts	3 culverts	5 culverts	No direct or indirect effect from this action.	Direct improvement in meadow condition through improved water regime that will improve species diversity from a Kentucky bluegrass dominated meadow to a sedge/rush/spikerush community. This will improve habitat for small mammals and birds and aquatic species.	Improvement in PFC. Improve vegetative condition with desirable riparian species over time. Will take approximately 2 years for riparian species to begin to occupy the site.	Some potential habitat disturbance during construction, however habitat at Dick Hart, 321C, and Holder Cabin are marginal now. Will create ponded wetland where one currently does not exist. Will improve capillary action to hold water on-site, creating potential habitat for aquatic dependent species. Re-vegetation will create habitat components for riparian-dependent species. Will not have a direct effect for cavity nesting species, but will improve insect habitat over time for feeding opportunities. Will re-locate elk and deer while site protection measures are in place (8' fence).
Rehabilitate or remove wood structures in Buck Springs and Houston Draws.	0 structures 0 miles	15 structures or 1 mile	15 structures or 1 mile	No direct or indirect effect from this action.	Direct negative effect through ground-disturbing activity, indirect long-term positive effect due to improved water movement through the system (energy dissipated rather than through gullies). Improved PFC over time. Will improve habitat conditions for mammals, birds and aquatic species.	Short term decrease through ground disturbance, long term improvement through removal of vertical banks and headcuts.	Short-term direct effect (negative) to habitat through ground disturbance for aquatic and riparian dependent species. Indirect positive effect to improve riparian conditions through the change in how water moves through the system and decrease in vertical banks and headcuts associated with failing structures. Will

Chapter 3 Affected Environment and Environmental Consequences
East Clear Creek Watershed Health Environmental Assessment

Measure Activity/ Treatment	Alt A summary	Alt B summary	Alt C summary	Effects on fuel buildups	Effects meadows	Effects on sediment	Effects on Habitat Components
							improve habitat conditions for mammals, birds and aquatic species over time. Will not have a direct effect for cavity nesting species, but will improve insect habitat over time for feeding opportunities.
Maintain the weir at Buck Springs.	0 acres	1 structure	1 structure	No direct or indirect effect from this action.	Minimal direct or indirect impacts to meadows because the site at the north end of Buck Springs meadow. If the structure is not maintained, there is potential for end cutting and a headcut advancing into the Buck Springs meadow.	Reduction of sediments from end cutting will decrease downstream sediment loads in this reach. Indirect positive effect to habitat downstream.	No direct effect to habitat components, but will improve long-term habitat through cessation of endcutting and a potential headcut. Will maintain current upstream habitat and thus have a positive indirect effect to aquatic species and birds and small mammals.
Remove roadbed and return natural flow regime in 7 miles of non-riparian drainages.	0 miles	7 miles	7 miles	No direct or indirect effect from this action.	No activities are in meadows. Indirect improvement through change in water regime (mitigated impacts from roads)	Direct negative effect through ground disturbance and potential sediment source. Over time will improve water regime on-site (direct effect) and throughout the watershed (indirect effect). This will reduce sediment movement out of the system, and improve habitat	Will have negative direct impact on vegetation through ground disturbance, thus affecting habitat components for ground dwelling species for the short-term. As vegetation becomes re-established, this effect will be minimized. Will have direct positive impact

Chapter 3 Affected Environment and Environmental Consequences
East Clear Creek Watershed Health Environmental Assessment

Measure Activity/ Treatment	Alt A summary	Alt B summary	Alt C summary	Effects on fuel buildups	Effects meadows	Effects on sediment	Effects on Habitat Components
						conditions.	through changing the water regime on-site and an indirect off-site improvement in the water regime that will improve habitat conditions for aquatic , riparian dependent and ground-dwelling species over time.
Trail construction/obliteration at General Springs	0 miles	0 miles, 0 acres	.23 acres of new trail; 0.1 mile of obliterated trail	No direct effect from this action. Indirect effect to fuel loading is long-term if meadow condition improves enough to create enough dead/decadent grass to carry fire.	Improvement of General Springs meadow through trail realignment and headcut treatment.	Short-term increase in sediments through ground disturbing activity. Long-term will provide less disturbance to General Springs and less sediment production.	Direct positive effect by removing sediment sources, improved habitat below enclosure in grass/sedge community due to less trampling disturbance.
Meadow restoration through thinning > 9" conifers in meadows	0 acres	0 acres	330 acres	Some slight increase in down fuel loading in meadows from thinning slash. Indirect effect to fuel loading is long-term if meadow condition improves enough to create enough	Direct improvement in habitat conditions through slash placement to protect grass/forb species and microclimate creation Some small direct negative impacts from the activity to cut the trees	No direct impact to sediments from the activity of felling trees, but will have a direct and indirect effect to improved soil condition.	Habitat components that will be improved include direct improvement in small mammal hiding cover from slash, improved species diversity under slash from microclimate and

Chapter 3 Affected Environment and Environmental Consequences
East Clear Creek Watershed Health Environmental Assessment

Measure Activity/ Treatment	Alt A summary	Alt B summary	Alt C summary	Effects on fuel buildups	Effects meadows	Effects on sediment	Effects on Habitat Components
				dead/decadent grass to carry fire.	but is it more related to disturbing species (elk, deer, and turkey) while the activity is occurring, and is not long-term.		protection from grazing and an improved water availability for plants. As such, habitat components will improve for riparian dependent species, turkey, and prey availability for MSO, goshawk and insectivorous and seed eating birds. An indirect effect to aquatic species may occur through improved water availability through the removal of efficient transpiring trees.
Stabilize stream crossings on 28 roads for a total of 2 miles.	0 miles	28 stream crossings and 2 miles	28 stream crossings and 2 miles	No direct or indirect effect from this action.	No direct improvement in meadows from this action. Indirect improvement through change in water regime (mitigated impacts from roads)	Negative direct effect through on-site disturbance, but also on-site positive effect to minimize sediments through completed construction activities. Energy dissipated at stream reaches, thus dropping sediments out and not carrying them through the system.	Indirect positive effect by changing water regime and slowing water movement throughout the system. Less downcutting, improved potential to increase wetted perimeter in riparian areas (12 crossings), thus increasing habitat potential. Aquatic species and riparian dependent species will have the greatest positive long-term benefit from this action.

Chapter 3 Affected Environment and Environmental Consequences
East Clear Creek Watershed Health Environmental Assessment

Measure Activity/ Treatment	Alt A summary	Alt B summary	Alt C summary	Effects on fuel buildups	Effects meadows	Effects on sediment	Effects on Habitat Components
Thin around McFarland, Merritt, and Upper Buck Springs to Improve spring flow	0 acres	100 acres	100 acres	Live fuel loading will decrease, but will be transferred to dean and down fuel loading. Positive indirect effect due to reduction of continuous canopies will decrease crown fire potential.	No direct effect on-site, but indirect effect to meadow systems in Houston Draw, Merritt, and Buck Springs through increased yield of water from springs. Yield will decrease over time as site re-establishes.	Short-term direct negative effect to soil condition (erosion potential) through ground disturbance. Approximate ground disturbance should be less than 10 acres. Direct positive effect to soil condition through lop and scatter of slash on-site.	Indirect positive effect through stabilized soils and increase in potential for grass cover due to slash cover. Indirect positive effect to meadow systems (Houston, Merritt, and Buck Springs) from increases water available, potentially improve wetted area. Aquatic species and riparian dependent species will benefit most from the increase in water in these meadow systems. Improved vegetative conditions in meadows will improve habitat components for a variety of species.
Treatments on 321C road to minimize damage to meadow system from vehicles.	0 miles	15.6 acres of rec improvements and 4.3 miles of road mitigation	15.6 acres of rec improvements and 4.3 miles of road mitigation	Minimal direct effect through thinning of small trees will increase dead/down fuel loading but reduce canopy connectivity. Indirect effect of developed dispersed sites is that it may increase use and increase human-caused risk.	Direct positive effect from limiting vehicular use to meadow system, thus removing the vehicle impact and improving the potential for improved meadow conditions. The raised culverts in Alt C will have similar positive effects as the raised culvert discussion above.	The raised culverts and energy dissipaters on three culverts will minimize sediment input. There could be short-term negative effects from the skidding of poles to sediment production and construction activities on culvert installation.	Improved meadow conditions will improve habitat conditions for small mammals, aquatics species, riparian dependent species and birds. Will re-locate elk and deer while site protection measures are in place (8' fence). Developed dispersed sites may actually increase use in the are, which will cause more disturbance to species. Off-site improvement to aquatic and riparian species may occur.

Chapter 3 Affected Environment and Environmental Consequences
East Clear Creek Watershed Health Environmental Assessment

Measure Activity/ Treatment	Alt A summary	Alt B summary	Alt C summary	Effects on fuel buildups	Effects meadows	Effects on sediment	Effects on Habitat Components
							downstream through moderation of runoff events.
Treatment on 643A road/Holder Cabin area to minimize impacts to meadow and drainage from vehicles.	0 acres	15 acres	15 acres and one raised road bed and culvert for 0.2 miles	Minimal direct effect through thinning of small trees will increase dead/down fuel loading but reduce canopy connectivity. Indirect effect of developed dispersed sites is that it may increase use and increase human-caused risk.	Direct positive effect from limiting vehicular use to meadow system, thus removing the vehicle impact and improving the potential for improved meadow conditions. The raised culverts and road bed in Alt C will have similar positive effects as the raised culvert discussion above.	The permeable road bed and raised culverts and energy dissipaters on the new road in alt c will minimize sediment input. There could be short-term negative effects from the construction activities.	Improved meadow conditions will improve habitat conditions for small mammals, aquatics species, riparian dependent species and birds. Will re-locate elk and deer while site protection measures are in place (8' fence). Developed dispersed sites may actually increase use in the are, which will cause more disturbance to species. Off-site improvement to aquatic and riparian species may occur downstream through moderation of runoff events.

Chapter 3 Affected Environment and Environmental Consequences
East Clear Creek Watershed Health Environmental Assessment

Measure Activity/ Treatment	Alt A summary	Alt B summary	Alt C summary	Effects on fuel buildups	Effects meadows	Effects on sediment	Effects on Habitat Components
Road obliterations	0 miles	0 miles	3.8 miles	No direct or indirect effect from this action.	No roads are being obliterated in meadows.	Short term increase in sediment production due to soil disturbance. Indirect positive effects as water is slowed through these locations due to a return to natural channel shape. This will decrease stream energy	Indirect positive effect by changing water regime and slowing water movement throughout the system. Less downcutting, improved potential to increase wetted perimeter in riparian areas. This will improve habitat conditions for small mammals, aquatic and riparian dependent species and ground-dwelling species.
Energy dissipater installation (paving) on 95 and 96 roads.	0 acres	2 acres (4 sites)	2 acres (4 sites)	No direct or indirect effect from this action.	No direct or indirect effect from this action (no meadows downstream from these actions)	Direct positive effect through a reduction in sediments and reduction in energy from the roads through energy dissipater construction.	Direct (on-site) and indirect positive effect due to a change in the timing and delivery of water to East Clear Creek and Houston Draw. This will improve water quality for aquatic species and an improvement in riparian habitats.
30 acres area closure at Dane Springs and 15 acre closure at Dines Tank to	0 area closurs	40 acres	55 acres	No direct or indirect effect from this action.	No direct or indirect effect from this action (no meadows downstream from these actions)	Positive reduction of sediments from road and control of motorized equipment will stabilize the site over time. Over the long-term, reduced	Direct positive effect to aquatic species through a reduction in site disturbance and sediment production. Indirect positive effect due to a

Chapter 3 Affected Environment and Environmental Consequences
East Clear Creek Watershed Health Environmental Assessment

Measure Activity/ Treatment	Alt A summary	Alt B summary	Alt C summary	Effects on fuel buildups	Effects meadows	Effects on sediment	Effects on Habitat Components
minimize impacts to the spring from vehicles						sediment would improve water quality in Dane Canyon.	change in the timing and delivery of water and minimizing future impacts. This will decrease the amount of disturbance for wildlife at the springs for a water sources. If use by wildlife increases to the point that it destroys riparian vegetation, it will be a negative effect.

Table 7 : Summary of effects to non-TES species from the proposed actions within the three alternatives. This table summarizes effects from the wildlife specialist report [99,107, 76,105). The action that is occurring is listed in column 1. The amount of acres, miles or structures within each actions within each alternative are listed in columns 2 through 4. Columns 5 through 8 contain the effects by measures used in the analyses. Where short-term negative effects are displayed, Best Management Practices (BMP's) are prescribed to mitigate negative effects on the action alternatives. A complete list of BMP's can be found in chapter 2, table 4 of this EA and within the soil and water specialist report (104). Aquatic species mentioned in the table above include, but are not limited to the following: Little Colorado spinedace, bluehead sucker, roundtail chub, Little Colorado sucker, narrow-headed garter snake, arizona southwestern toad, northern leopard frog, macroinvertebrates and the Chiricahua leopard frog. Riparian dependent species include, but are not limited to the following: Southwestern willow flycatcher, spotted skipperling, blue-black silverspot butterfly, Maricopa Tiger Beetle, Tiger Beetle, and mountain silverspot butterfly.

**Table 8 : Summary of Watershed Health Effects
Mexican spotted owl habitat**

	ACTIVITY	ALT A NO ACTION	ALT B PROPOSED ACTION	ALT C MODIFIED PROPOSED ACTION
PROTECTED HABITAT	Burning in PACS	0 acres	0 acres	0 acres
	Burning in other protected habitat	0 acres	188 acres	1,600 acres
	Thinning in PACS	0 acres	0 acres	0 acres
	Thinning other protected habitat	0 acres	0 acres	5 acres
RESTRICTED HABITAT	Burning in Target-threshold habitat	0 acres	193 acres	1,900 acres
	Thinning in Target-threshold habitat	0 acres	N/A	6 acres
	Burning in Other restricted habitat	0 acres	2,560 acres	6,900 acres
	Thinning in other restricted habitat	0 acres	0 acres	4,000 acres
OTHER HABITAT	Burning	0 acres	7,500 acres	9,200 acres
	Thinning	0 acres	0 acres	5,400 acres

Table 8: This table displays the acres of treatment within various habitat types for Mexican spotted owl within the analysis area. A definition of habitat types (protected, restricted) can be found in the wildlife specialist report [99,107].

the cumulative impacts under the control of the Forest Service (roads, recreation, and fire exclusion) that are occurring within the analysis area and will improve conditions for wildlife in the long run. Overall, the proposed activities under Alternatives B and C minimize the existing cumulative impacts to wildlife within the analysis area and do not create further cumulative impacts.

Overall, the actions proposed in Alternatives B and C of this project are designed to improve watershed conditions, reduce fuels and stagnant doghair thickets, re-introduce a natural fire regime, and improve riparian function. Cumulatively, the Buck Springs Range Allotment EIS, the Victorine Wildlife Urban interface Project and the Blue Ridge Wildlife Urban Interface Project will work in concert to promote these improved conditions throughout the East Clear Creek Watershed. Grazing pressures would be reduced through implementation of the Buck Springs Range Allotment Environmental Impact Statement and through ongoing efforts of the Arizona Game and Fish Department to reduce elk populations. Recreation and road impacts would be reduced through this project. Short-term impacts due to construction activities would include potential increases in sedimentation to drainages, and losses of small pieces of potential habitat for a few sensitive aquatic dependent species. These same species, along with several threatened and endangered species would benefit over the long-term by improvements in watershed conditions, reduced threats of catastrophic fires, increases in suitable habitat and improvements in riparian function.

Recreation and Visual Quality

[103]

Affected Environment

Recreation Sites/Uses There are two developed campgrounds within the analysis area. The Rock Crossing Campground sits above and to the north of Blue Ridge Reservoir and within a short drive of the boat ramp and access. Trails lead to popular fishing spots. The Knoll Lake Campground is located on the southeastern boundary of the analysis area, on Knoll Lake. Boating and fishing are popular activities on the lake.

Dispersed recreational use can be characterized by the common themes of summer activities, winter activities, consumptive use of forest resources, and educational/person development type activities. An estimated 70% of the visits to the area occur during the summer season (Memorial Day to Labor Day). It is estimated that a full 90% of the users are Arizona residents, with many users returning to their favorite sites or settings on an annual basis.

Trail systems run through the entire analysis area, including the Arizona Trail, U-Bar, Barbershop, Fred Haught, Houston Brothers, Babe Haught, Rock Crossing, and

General Crook National Historic Trail. Recreational activities include: hiking; viewing wildlife; dispersed car-camping; backpack camping; water-based activities such as boating, canoeing, and water play; orienteering; horseback riding, caving, rock climbing, photography, picnicking; taking scenic drives; bicycling; off highway vehicle travel; shooting; and gathering in family or social groups. Off Highway Vehicle (OHV) use has increased dramatically in the last several years. Some areas within the analysis area are showing signs of use from OHV's, while more fragile areas appear abused from OHV use.

The local hunting seasons last from about mid-August through December and accounts for many of the fall visitors to the area. The winter snow pack generally limits access from most recreational users from mid-December to mid-March.

The gathering of forest resources often ties the need for subsistence with the pursuit of recreational experiences. Consumptive use within the analysis area includes: firewood cutting; post and pole cutting; Christmas tree cutting; collecting boughs and cones; collection and transplanting of wildlings; collection of native mineral resources (i.e.: sandstone, chert); fishing; hunting; gathering antlers; collecting food and medicinal resources such as berries, nuts, mushrooms, and bracken fern; and collecting biological specimens for research.

Lands and Recreation Special Uses Arizona Public Service is under permit for overhead power transmission lines that cross the analysis area. Knoll Lake and Blue Ridge Reservoir are under special use authorizations to the Arizona Game and Fish Department and Department of Energy respectively. There are several temporary special use permits and currently include guided hunting and ATV services.

Wild and Scenic Rivers East Clear Creek, Leonard Canyon and Barbershop Canyon were been evaluated for potential Wild and Scenic River designation in 1993. In a preliminary assessment, East Clear Creek and Barbershop Canyon had two outstandingly remarkable values (ORV's) identified, fisheries habitat and scenic value. The Barbershop Canyon section was determined to be potentially eligible for a Wild classification. The East Clear Creek segment was determined to be potentially eligible with a Scenic classification. Leonard Canyon had only one single outstandingly remarkable value recognized, that being fisheries habitat. This segment was determined in the 1993 study to be eligible as Recreational classification.

Inventoried Roadless Areas Inventoried Roadless Areas (IRA) have been delineated for the Coconino National Forest. These areas were first delineated under the RARE II roadless area review process in the early 1980's. The original designation as roadless areas has been included in the proposed Roadless Area policy that was formulated under the Clinton administration. This proposed policy is currently under review by the Bush administration.

The analysis area contains one complete IRA and a portion of another IRA within the boundaries of the analysis area. The 1,310 Barbershop IRA lies completely within the

boundaries of the analysis area. A total of 309 acres of the 2,035 acre East Clear Creek IRA lies within the boundary of the analysis area. These two IRA's were considered for inclusion into the Wilderness System under the Arizona Wilderness Bill in August of 1984, but were not included because they were considered too small.

Recreation Opportunity Spectrum and Visual Quality The Forest Plan lists the Recreation Opportunity Spectrum classes within the analysis area as Roaded Natural Appearing (RNA) on 64,891 acres, Semi-Primitive Motorized (SPM) on 4,322 acres, and Semi-Primitive Non-Motorized (SPNM) for 1,312 acres in the two designated roadless areas in the analysis area (Barbershop Canyon and East Clear Creek). Visual Quality Objective (VQO) designations include 17 acres of maximum modification along Mogollon Rim Ranger Station, 42,408 acres of modification which occurs on the ridge tops, 19,373 acres of partial retention designation which occurs in canyons, and 7,908 acres of retention that occurs along State Highway 87, the Mogollon Rim and around Blue Ridge Reservoir.

Effects of Alternative A

There are no improvements proposed under this alternative, therefore there would no direct impact (positive or negative) to recreation activities from this alternative. Indirect effects to other resources would increase over time as use increases over time. There are no changes to the Wild and Scenic Rivers or Inventoried Roadless Area, in this alternative.

Effects of Alternatives B and C

Under alternative B, the major impacts from the proposed set of activities will be the removal of seven miles of old road beds, the road closure into Dane Springs and installing pole fences along the 321C road [103]. These actions will mainly affect OHV users and dispersed camping through dislocating individuals from traditional areas of use. Users will express their reaction to these changes in one or more ways: complaining, violating the closures, vandalizing the site or moving to another area [103]. Thinning and large scale activities that tend to take place over time will mostly go unnoticed by the recreating public. Relocating the road at the Holder Cabin meadow will not affect users for access to camping, however, they will be limited from OHV use in the meadow itself. Trail users will notice short-term effects from the construction activity. The long-term effects of these activities will be positive, with an increase in open stands that are more visually pleasing and an increase in the amount of water flowing in the streams, None of the proposed activities in Alternative B would result in any change in ROS class designation.

Under Alternative C, there are similar effects as Alternative B to dispersed recreationists, with access issues creating the largest effects. Aside from those activities listed above that are affecting dispersed recreationists (321C, Dane Springs Closure, and 7 miles of reshaping of old road beds), the Dine's Tank closure will also create similar effects through dislocation of use [103]. The effects of the Holder Cabin

road will be the same as Alternative B. The larger acres of prescribed burning (19,700 acres), as well as the proposed thinning of 9,200 acres will result in a short-term scenic impacts and long-term improvement to scenic quality [103].

In Alternative C, the trail system (especially Fred Haught and Barbershop Trail), will experience positive changes, where re-routing portions of the trail and restricting vehicle access will create benefits to the users, while reducing impacts from trails on streams [103]. Alternative C will have more restoration activities along trails than Alternative B, and therefore trail users will notice more short-term visual effects from the construction activity. The long-term effect is similar to alternative B, with an increase in open stands that are more visually pleasing and an increase in the amount of water flowing in the streams, which will be a long-term benefit to the recreating public. Under Alternatives B and C Recreation and special land uses may have impacts to the small mammal group (NAU research permit) may be unable to conduct research during construction activities to rehabilitate the streambanks. Changes to meadow camping areas in the 321C area may curtail some organized large group camping that may have taken previously [103]. There are not expected to be any changes to the scenery outstandingly remarkable value (ORV) in the Barbershop or East Clear Creek Wild and Scenic River Designation areas. The fisheries ORV's are expected to improve over time for the Barbershop, East Clear Creek or Leonard Wild and Scenic designations. No changes are expected with the Inventoried Roadless Areas under either alternative.

Cumulative Effects

The cumulative effect of increasing population will create more potential for recreation effects to the analysis area. The on-going Arizona Off Highway Vehicle Forest Plan Amendment - For Apache-Sitgreaves, Coconino, Kaibab, Prescott, and Tonto National Forests analysis once completed and implemented will minimize the effects from Off Highway Vehicles (OHV's) by limiting areas of use. This will aid in minimizing the potential impacts from OHV's on forest resources. However, without enforcement and education of the public, there is a potential for increased damage from recreation use in the future.

Cultural Resources

Affected Environment

There are 7 identified cultural resource sites within the the proposed treatment areas. Site types are all historic period sites. The General Crook Trail also traverses the southern portion of the analysis area. All of the sites are considered potentially eligible for the National Register under Criterion D of 36-CFR-60.4 and will be considered eligible for Section 106 purposes for this project [110].

Effects of Alternative A

The no action alternative does not have any activities that could disturb the existing sites, therefore, there will be no direct effect to these sites. Long-term negative effects could happen to sites through continued bank erosion in drainages, particularly to Pinchot Cabin in Houston Draw. The long-term effects of increased fuel loading will be discussed in the cumulative effects portion of this section.

Effects of Alternatives B and C

All proposed activities within each alternatives will have site specific cultural resource survey and approval completed prior to implementation, so there will not be any direct effects to cultural resource sites. All sites will be protected from any disturbance. Long-term indirect effects to the Pinchot Cabin site could be realized through channel stabilization work that is occurring in Houston Draw for both alternatives. If any new sites are discovered during construction activities, they are to be reported to the Forest Archaeologist and ground-disturbing work will be halted. All 7 sites shall be protected pursuant to FSM 2361.1 (2) and FSM R-3 2361.21 (2) until testing or additional information is available that would allow for formal determination of eligibility to be made [110].

Cumulative Effects

Historic properties have potential for destruction from fire because they are generally wood structures. Thus, Pinchot Cabin, General Springs Cabin, Buck Springs Cabin, and Schneider Springs Cabin have the potential to be lost from high fuel loadings that have occurred from past fire exclusion policies. The potential increase in recreation activity within the analysis area does increase the potential to vandalism on historic sites.

Water Quality **[104]**

Affected Environment

East Clear Creek (Hydrologic Unit Code (HUC) 1502000808-67,774 acres), West Clear Creek (HUC 1506020391- 830 acres), East Verde River (HUC 1506020393- 729 acres), Upper Tonto Creek (HUC 1506010573- 1,084 acres) and Jacks Canyon (HUC 1502000809- 194 acres) are the watercourses that lie within the analysis area. In the 1996, 1998, and 2000 Arizona Water Quality Assessments by the Arizona Department of Environmental Quality (ADEQ), West Clear Creek is in full compliance for designated uses, East Clear Creek reaches 15020008-009 (ECC hdwt-Yeager Canyon), 15020008-008 (ECC, Yeager-Willow), and 1502008-009off4 (Barbershop Canyon, hdwt-ECC) are in full compliance for all designated uses.

The East Verde River (reach 15060203-022) is an impaired stream and on the 1996 303 (d) report with arsenic, low dissolved oxygen and turbidity being the identified stressors. East Clear Creek reach 1502008-008offBUCK (Buck Spring Creek, headwat-

ers to Leonard Canyon) is in partial support with dissolved oxygen and turbidity being the stressors on aquatic and wildlife designated uses. This assessment was made only once in 1995, and as such, does not have enough sample data to put it on the impaired stream list. Upper Tonto Creek (in the Salt River Watershed) reach 16060105-013 (Tonto Creek, headwater to Haigler Creek) is in partial support for phosphorus and nitrogen according to the 1996 ADEQ Water Quality Assessment. These parameters were exceeded only below the hatchery. Jacks Canyon is not perennial, and as such, was not monitored in the 1994 or 1996 report.

The designated uses for East Clear Creek reaches, the Tonto Creek reach and the East Verde River reach include the following: 1) aquatic and wildlife; 2) Full Body Contact; 3) Fish Consumption; 4) Agricultural Irrigation Watering; and 5) Agricultural Livestock Watering. The designated uses for West Clear Creek are: 1) Aquatic and Wildlife; 2) Full Body Contact; 3) Fish Consumption; and 4) Agricultural Livestock Watering. Jacks Canyon does not have designated uses specified.

Effects of Alternative A

The effects for this discussion will be limited to a discussion of the East Clear Creek watershed only. The other watersheds consist of small acreages of each of the watershed that the impacts to water quality are not large enough to quantify [104]. The direct effects to water quality under the no action alternative will be that the water quality will not degrade. Water quality may degrade in the future, specifically to turbidity as bank erosion continues throughout the watershed and road drainage structures fail due to lack of maintenance and increasing recreational use [104].

Effects of Alternative B and C

There will be short-term direct negative effect from ground-disturbing activities within each alternative that may increase the potential for the turbidity standard to be surpassed [104]. Best Management Practices to minimize these impacts are prescribed within the soil and water effects analysis report [104]. All projects within alternatives B and C are designed to provide for short-term and long-term improvements in watershed condition. The prescribed burning in both alternatives will decrease the threat of stand-replacing fires throughout the watershed, and as such will decrease the potential of large amounts of sediment and ash from entering the system from a large wildfire. This will provide an indirect benefit to water quality within the analysis area. The thinning in alternative C will provide a similar benefit.

The in-channel treatments as well as road mitigations will provide the greatest potential for short-term direct negative impact to water quality [104]. However, the short-term and long-term positive effects of restored channel bottoms, decreased vehicular use at Dines Tank, Dane Springs, and the 321C road of improved watershed conditions will assist in the maintenance of water quality that is currently within standards into the future.

Cumulative Effects

The success of maintaining water quality that meets standards is directly dependant on the successful implementation of the restoration efforts that are outlined in the action alternatives. As such, the cumulative effects that are most likely to negatively impact the success of the projects will be the impacts that affect water quality. These are discussed at length in cumulative effects discussion in the preceeding soil and wildlife sections above.

Much like the soil resources, Alternative C will provide the greatest benefit to water quality resources in the long-term, but will also provide the greatest potential short-term direct impacts from construction and fire activities. Alternative A has the least amount of direct impact to water quality resources from construction or burning activities, but maintains poor soil conditions and excessive erosion from headcuts and vertical banks that will degrade habitats, especially for the turbidity standard. Alternative A also has the greatest potential for a large stand replacing fire, which would be an indirect negative effect to water quality resources.

Vegetation

Affected Environment

The primary vegetation type within the approximately 70,000 acre analysis area is a ponderosa pine overstory with a variety of species in the understory, including, but not limited to, Arizona fescue, screwleaf muhly, gambel oak and buckbrush. This occurs on approximately 44,000 acres within the center portion of the analysis area. In the far northern portion of the analysis area the small amount of ponderosa pine/pinyon juniper type occurs on about 2,200 acres. In the southern portion of the analysis area, the elevation and precipitation increases and a mixed-conifer forest type occurs on approximately 23,500 acres. A majority of the area is in trees on the average of 60-120 years old, with scatterings of openings and old growth timber (USDA 1996). An additional 412 acres of meadow occur within the analysis area, which are currently dominated by the non-native Kentucky bluegrass. Exceptions to this do occur in wetter sites (where channels have not downcut) and in elk exclosure areas. Within the wetter sites, sedge, rush and spikerush occur. A limited amount of woody riparian occurs within the watershed, with Arizona alder being the main woody species. Bebb's willow does occur in the watershed, but it is limited due to the palatability of the species to ungulates prevents it from spreading successfully. Bebb's willow occupies sites historically that has fine soil substrates and Arizona alder occupies sites with courser substrates.

Noxious weeds also occur within the analysis area on areas that have been previously disturbed. Bull thistle is the primary noxious weed present, with a small population of cheatgrass [109]. Bull thistle is found primarily along roadsides in old log landing locations, as well as in Buck Springs meadow [109].

The following sensitive plant species may occur within the analysis area:

Arizona bugbane *Cimicifuga arizonica*; Mogollon thistle *Cirsium parryi mogollonicum*; Cliff fleabane *Erigeron saxatilis*; Mt. Dellenbaugh sandwort *Arenaria aberrans*; Rusby's milkvetch *Astragalus rusbyi*; Flagstaff pennyroyal *Hedeoma diffusum*; Arizona sneezeweed *Helenium arizonicum*; Eastwood alum root *Heuchera eastwoodiae*; and Flagstaff beardtongue *Penstemon nudiflorus*.

Mogollon thistle, cliff fleabane and Arizona sneezeweed have been documented within the analysis area. Potential habitat occurs within the analysis area for Arizona fleabane, Mt. Dellenbaugh sandwort, Rusby's milkvetch, Eastwood alum root and Flagstaff beardtongue. There also may be some small pieces of potential habitat for Flagstaff pennyroyal, however, the species has never been located south of West Clear Creek.

Effects of Alternative A

Short-term direct effects to vegetation under this alternative are minimal if there is not a stand-replacing fire. Biodiversity will decrease over time as overstory vegetation continues to close the canopy and light decreases to the forest floor. Vegetation in meadows will continue to be dominated by Kentucky bluegrass and there will not be an increase in species diversity in meadows.

Negative direct effects to mid to late successional species if a large, stand replacing fire did occur within the analysis area. A stand replacing fire could improve the conditions for aspen regeneration, as well as other early successional species. This would improve biodiversity of the sites, but high soil temperatures associated with stand replacing fires would lengthen the succession to mid and late seral stages due to damaged soils. In addition, as the length of time increases, the threat of stand-replacing wildfire increases [102], which would be a short-term negative effect to vegetation at the fire site.

The lack of disturbance within this alternative will not hasten the spread of noxious weeds within the analysis area [109]. An indirect negative effect may occur if a large stand-replacing fire would occur that would be ripe for spreading noxious weeds on a large scale.

The effects to the sensitive species within the watershed would be minimal for direct, short-term effects. However, there may be negative long-term effects for riparian dependent species (Eastwood alum root, Arizona sneezeweed, Arizona bugbane, Mogollon thistle, and cliff fleabane) due to loss of habitat from continuing degradation of riparian habitat in meadows, roads affects, and the threat of large wildfire.

Effects of Alternative B and C

The activities with the greatest impact to vegetation are the prescribed burning and thinning, primarily due to the relatively large acreages involved compared to the other treatments within Alternatives B and C. The removal of some of the needlecast through prescribed burning will also provide more areas for seed-bearing plants to become established—this includes noxious weeds. Thus, prescribed burning will provide the opportunity for increased plant diversity, which can be positive with native plant seeding, but can be negative through the establishment of noxious weeds. Prescribed burning will also provide a direct nutrient flush to species on-site that will be beneficial to plant growth [99,107]. Prescribed burning will also stimulate fire dependant species such as buckbrush and aspen, which will improve species diversity in the uplands. These effects are greatest for Alternative C that has a greater acreage to be burned than Alternative B.

Thinning to reduce fire risk will have a direct effect through improved growth of the remaining overstory trees. This effect is minimized through time as the remaining trees re-occupy the site [102]. Thus, a short-term positive effect to the overstory is gained through thinning in alternative C. Understory vegetation in the thinning units will also receive a short-term positive effect through an open canopy that will allow for the germination of new plants. There will be limited ground disturbance from mechanical operations (thought to be less than 5% of the area) from the cutting activity that may be a source of seedling establishment. As stated above, this could be either native seed establishment or a noxious weed, therefore, there could be both positive and negative effects to the understory vegetation from this action. Thinning around Buck, Merritt and McFarland Springs will have similar effects as the thinning to reduce fire risk.

The action alternatives will have some short-term direct negative effects to vegetation, particularly understory vegetation, where ground disturbing activities will take place (in-channel work, road obliterations, trail construction etc). The ground-disturbing activity will remove live vegetation and will make the disturbed site susceptible to invasion of noxious weeds [104]. Noxious weeds, once established, make it difficult for native vegetation to occupy the site and are generally shallow rooted which will contribute to a decline in soil productivity (and also a corresponding decrease in plant productivity) through an increase in erosion potential. Best Management Practices that are designed to re-establish vegetation, implementing the Forest's noxious weed strategy and to protect new plants from grazing are key to minimizing the nefarious effects of noxious weeds [104]. Long-term indirect effects to understory plants are expected to improve plant diversity through improved water-regimes (keeping water on-site longer to favor sedge/rush/spike-rush communities) [104]. Further improvements in understory vegetation will apply to the vehicle closure areas, but will be on small acreages and will likely not be detectable for the analysis area as a whole, but will be important on-site to minimize sediment movement.

The effects to sensitive species will be similar to other understory vegetation. There can be a direct negative effect if the plant is in a project area. This is not the case now, but this will be mitigated through thorough plant surveys prior to construction to ensure the plants are not on-site as they are now. The actions designed to improve watershed

condition will have an effect to improved habitat for Mogollon thistle, especially the Dane Springs enclosure where a known population exists [99,107]. Arizona sneezeweed may be negatively impacted from construction activities at the tank removal sites (which they are not known to exist at now), but improved habitat conditions in the long-term will improve the possibility for these species to occupy sites within the analysis area [99,107].

Cliff fleabane and Arizona bugbane will not show a direct effect due to the location of their habitat, but could show an indirect positive effect if improved watershed conditions keep water on-site longer than the present [99,107]. Potential habitat exists for Mt. Dellenbaugh sandwort, Rusby's milkvetch, Flagstaff pennyroyal, Eastwood alum root and Flagstaff beardstongue and the only project that would potentially effect them is the prescribed burn proposals. This effect is not thought to be a great enough effect to push any of the species towards federal listing [99,107]. Other proposed projects are not expected to effect these species [99,107].

Cumulative Effects

The current overstory/understory dynamics are related to past practices that have shaped the current distribution of ponderosa pine and mixed conifer within the analysis area. Past grazing practices also has played a role in allowing for increased live fuels in the overstory. Thus the cumulative impacts of these past practices are still affecting the analysis area in Alternative A. Alternative B will begin a short-term reversal of the cumulative impacts of these actions, and Alternative C will take a larger step towards reversing the cumulative fuel loading issue that threatens vegetation within the analysis area [102].

As stated above in other cumulative effects discussions, on-going grazing could make or break the success of revegetation of disturbed sites. The cumulative and on-going effect of elk grazing is mitigated through BMP's and through increased hunt numbers proposed by the Arizona Game and Fish Department.

Alternative C will provide the greatest impact to vegetation, primarily through the large acres of prescribed burning and thinning. There will be a mix of both positive and negative effects from the actions in alternative C, but the increased health and vigor of plants and the decreased threat of wildfire outweighs the potential negative effects of increased noxious weed establishment.

Air

Affected Environment

The entire analysis area falls within the Little Colorado Airshed. There are no Class 1 or non-attainment areas within this airshed [102].

Effects of Alternative A

There will be no changes in short-term or long-term affects to air quality as a result of a "No Action" alternative. However, this alternative does increase the long-term potential for a crown-replacing wildfire that will emit considerable amounts of smoke and airborne particulates, but these wildfires generally occur during unstable atmospheric conditions when optimal smoke dispersal conditions exist.

Effects of Alternative B and C

Prescribe burning will generate smoke and airborne particles, and negatively affect the airshed on a *short-term* basis. Some of these impacts can be reduced (see Mitigations) through timing of the burn and scheduling the burn to be completed during periods of favorable atmospheric conditions. Impacts will be greatest on the day of ignition with decreasing impacts lasting 2 to 4 days following a single days ignition, and up to 1 to 2 weeks following multiple day ignitions.

Much of the smoke that is generated by prescribe burning in the Buck Springs analysis area will pass over East Clear Creek during the daytime with winds that are predominately out of the southwest. Nighttime flows of smoke will be downhill, down stream into East Clear Creek. This will result in heavy concentrations of smoke at the bottom of East Clear Creek with moderate to light concentrations at higher elevations resulting in some light nighttime smoke impacts to residents in the Blue Ridge area [102]. Alternative C has the greatest potential to impact air quality because of the higher amount of acreage that is proposed under this alternative than any of the other alternatives.

Cumulative Effects

Cumulative effects of smoke from prescribe burning will be short-term, but will increase in magnitude as the number of treatment acres increase. These impacts can also be potentially magnified by treatments from adjacent areas such as the Apache-Sitgreaves N.F., Tonto N.F., Fort Apache Indian Reservation, and prescribe burning on private properties [102]. However, the cumulative effects from smoke from adjacent areas is mitigated and regulated by Article 15, Forest and Management Burn Rules (10/8/96). The Arizona Department of Environmental Quality (ADEQ) strictly models emission/pollutants from all prescribed burning within the state. Any prescribed burn planned by the any entity must be approved by ADEQ on a daily basis. ADEQ will not allow more acres burned per day, per airshed, than is acceptable with current air quality conditions.

Economics

Affected Environment

Northern Arizona's economy has long been tied to agricultural-based activities such as ranching and logging. With urbanization and the associated changes in values have come changes in the economic base of this area. Tourism is now considered the leading industry in Northern Arizona. Recreation users contribute to the economy when they purchase hunting and fishing licenses and permits, pay fees at the campgrounds and purchase goods and services needed for particular activities. Indeed the revenues generated by hunting and fishing in Arizona alone are estimated by Congressional Sportsman's Foundation as equal to \$140/resident, with added tax revenues equal to \$16/resident. Many of these purchases are made locally, but may be made at other locations throughout the State and region. As stated in the recreation section of this chapter (section 3.3), total recreation use will not change within the analysis area by any of the proposed activities but it will be shifted to different locations. The main discussion within this section will be to display the costs of the proposed alternatives. No known products will come from the proposed activities, therefore all benefits will be non-market in nature.

Effects of Alternative A

There are no costs associated with this alternative, nor are there any monetary benefits from this alternative. There will be no improvement in the non-market benefits derived from the project, and there will be a degradation of the biodiversity.

Effects of Alternative B and C

Costs Costs associated with alternatives B and C are displayed in Chapter 7, Appendix H below. For the cost analysis, assumptions were made for the timing of each treatment. The assumptions were kept constant for each alternative so that comparisons could be made between the alternatives. The timing of the actual implementation of each activity within each alternative may not meet the schedule listed within the EA due to funding considerations. Appropriated dollars are not guaranteed from year to year and implementation is subject to these dollars. If grants are attained for project implementation, the schedule could be accelerated. The list of assumptions and the timing of implementation can be found in Chapter 7, Appendix H below. Costs are greater for Alternative C than Alternative B due to more actions being proposed in this alternative.

Benefits All benefits for this analysis are non-market benefits, and as such are subjective to each individual. The only products created from this analysis are trees less than 12" diameter at breast height and there currently is not a market for small trees. If this changes in the future, a revenue stream could be realized for these products. As such, a narrative discussion follows on non-market benefits for each alternative. The following narrative discusses the non-market benefits resulting from the implementation of the different alternatives. Non-market benefits are either consumptive or non-consumptive. Consumptive benefits are those things that require something physical be removed from the site or have the potential to physically affect

the site. Non-consumptive benefits are those in which nothing physical is removed from the site and there is no potential to physically affect the site.

Soil and Watershed Conditions Improved soil and water conditions through improved watershed conditions are both consumptive and non-consumptive in nature. Consumptive benefits include an increase in water flow and a longer duration of flow. This benefit would primarily aid downstream users of the water (Winslow and tribal users), as well as anglers (primarily downstream of the dam).

Non-consumptive benefits of improved soil and watershed conditions are tied to recreation benefits. Improved flow and duration of flow would allow recreationists an increased opportunity to visit sites with water. Also, with improved riparian conditions comes an increase in biodiversity. Examples of non-consumptive benefits of improved riparian conditions include recreational camping, sightseeing, birding, hiking, and wildlife viewing.

Improved soil stability and productivity benefits result when the existing soil remains in place or conditions are created so as to enhance either on-site soil creation or retention of soil deposited from off-site. This leads to improved soil productivity, which in turn would lead to increasing vegetative biomass and species diversity.

Other non-market benefits include ceremonial and medicinal benefits from improved soil and watershed conditions, and in particular improvements in native plant biodiversity, and educational opportunities. Consumptive ceremonial and medicinal benefits include the gathering of ceremonial and medicinal items. Opportunities for this activity would be expected to increase as riparian habitat improves. Non-consumptive uses include the passing on of ceremonial and medicinal knowledge to younger generations. Educational non-consumptive benefits include research opportunities and improving the level of awareness about the function of properly functioning watersheds, soils, and riparian areas.

Alternative C has the best chance to improve these non-market benefits because it would provide the greatest improvement to the riparian areas and soil and watershed conditions. Alternative A would improve non-market opportunities the least because it will not improve watershed conditions over time.

Research and knowledge is another non-market benefit that can be assigned to the analysis area, however, either implementing an action alternative or not implementing an action alternative does not preclude research activities from occurring within the analysis area. Therefore, all alternatives considered can consider this as a non-market benefit.

Environmental Justice

The Forest Service explored the social, economic, and environmental impacts of this project and determined that none of the alternatives considered in this analysis would

have a disproportionate impact on any minority population in the immediate area, within the surrounding counties, or in the Northern Arizona region [100].

Description Of Relevant Past, Present, And Foreseeable Future Actions Not Part Of The Analysis

Past Actions

Past actions that have taken place within the analysis area include livestock grazing, fire suppression, wood product harvesting (pulpwood, sawlogs, and firewood), road construction to harvest wood products, the introduction of elk, water tank building, prescribed burning, recreation use and reservoir construction. A thorough discussion of the summary of these actions can be found in the following project record documents.

Table 9: Summary Table of Documents That Relate to Past Actions

Item Number	Description
USDA 1996	East Clear Creek Collaborative Team Existing Conditions. Histories of all resources within the East Clear Creek watershed.
108 in project record	Cumulative Effects Analysis—summary of past activities within the East Clear Creek Watershed, including range allotments, timber sales within the last 20 years, recreation site summaries.

Present Actions

Present actions that are occurring within the analysis area include cattle grazing within the Buck Springs Range Allotment, developed and dispersed recreation, timber sales, road maintenance, fire suppression, permitted hunting, prescribed burning, timber stand improvement, electrical generation and special uses. Specific projects that are ongoing are listed within Table 10. Additional discussion of current activities can be found in the Cumulative Effects Analysis [108].

Reasonably Foreseeable Future Actions

Table 11 lists the reasonable and foreseeable future actions that may take place within the analysis area. Additional discussion of current activities can be found in the Cumulative Effects Analysis [108]

Predicted Attainment of Project Objectives

This section of the analysis discloses how well each proposed alternative meets the objects of the analysis that were outlined in section 1.6 of this document.

Predicted Attainment of Objective #1

Maintain existing satisfactory soil conditions and vegetative conditions. Minimize impacts and ameliorate soil conditions at recreation sites, roads and trail system, skid trails and landings. Increase vegetative ground cover to 60-80% of potential in meadows in the 10 years of this plan, and to at least 90% of potential by the year 2020.

Table 10: List of Present Actions Occurring Within the Analysis Area

Project Name	Type of Activities
Blue Ridge Urban Interface Project	Prescribed burning and timber stand improvement (thinning of small ponderosa pine)
Buck Springs Range Allotment	Cattle grazing
M-C Timber Sale	Multi-product pulp and sawlog timber sale
Blue Ridge Reservoir	Pump of water off rim (off-analysis area) to generate electricity
Hunting/Fishing	Under permits issued by Arizona Game and Fish
Supplemental stocking	Supplemental stocking of Little Colorado spinedace
Developed Recreation	Developed campsites at Knoll Lake.
Annual Road Maintenance	Road blading and maintenance on FR 95, 96, 300, 321, 139, and 137 road.
Lockwood Pit Rock Crushing	Rock crushing for road maintenance at Lockwood Pit

Table 10: List of present actions that are currently operating within the approximately 70,000 acre East Clear Creek Watershed Health Project.

Table 11: List of Reasonable and Foreseeable Future Actions

Project Name	Type of Activities
Victorine Wildland Urban Interface Project	Prescribed burning and timber stand improvement (thinning of small ponderosa pine)
Buck Springs Range Allotment	Cattle grazing
U-Bar Timber Sale	Multi-product pulp and sawlog timber sale
M-C Timber Sale	Multi-product pulp and sawlog timber sale
Crackerbox Timber Sale	Multi-product pulp and sawlog timber sale
Clear Creek Timber Sale	Multi-product pulp and sawlog timber sale
Blue Ridge Reservoir	Pump of water off rim (off-analysis area) to generate electricity

Hunting/Fishing	Under permits issued by Arizona Game and Fish
Supplemental spinedace stock	Supplemental stocking of Little Colorado spinedace
Arizona OHV Forest Plan Amendment - For Apache-Sitgreaves, Coconino, Kaibab, Prescott, and Tonto National Forests	Limit off-road driving
Noxious Weeds (Four Forest Assessment)	Treatments to limit the spread and control of noxious weeds
Developed Recreation	Developed campsites at Knoll Lake.
Annual Road Maintenance	Road blading and maintenance on FR 95, 96, 300, 321, 139, and 137 road.
USFS/AZ Game and Fish/US Army Corps of Engineers Watershed Recovery Project	Channel restoration and fish barrier construction on Coconino and A-S NF's within the ECC watershed

Table 11: List of reasonable and foreseeable actions that are expected to occur within the East Clear Creek Watershed Health analysis area.

Alternative A Soil conditions in meadows are expected to remain the same under this alternative, or degrade over time. This objective will not be met under this alternative [104].

Alternative B The proposed action will improve soil conditions in meadows through specific actions designed to improve soil conditions [104]. Specifically, channel work will minimize erosion potential through laying back of banks (3 miles); stopping headcuts at 12 sites; maintaining the weir at Buck Springs; rehabilitating 15 structures at Buck Springs and Houston Draw; stabilizing 3 miles of road crossings through improving drainage and installing energy dissipaters on culvert outlets; reshaping 7 miles of drainage bottoms where previously obliterated roads have created accelerated erosion; minimizing impacts to meadows and riparian areas from recreationist at Dane Springs, 321C, and Holder Cabin; and paving of 4 sites on the 95/96 roads to minimize sediments. An indirect benefit to soil condition is the risk reduction from stand-replacing fire on at least 10,000 acres through prescribed burning

The success of these treatments is dependent on the ability of the disturbed site to be able to recover with vegetative species that will disperse energy. The main stressor on the recovery of vegetation after ground-disturbance is grazing ungulates. As such, BMP's have been outlined to protect vegetation from grazing ungulates (particularly from wild ungulate grazing). With BMP's in place, this alternative will improve soil condition better than Alternative A, but not as well as Alternative C (see below).

Alternative C The proposed action will improve soil conditions in meadows through specific actions designed to improve soil conditions [104]. Specifically, channel work will minimize erosion potential through laying back of banks (3 miles); stopping headcuts at 12 sites; raising culverts to create ponded wetlands and installation of

energy dissipaters on new culvert arrays at Dick Hart and Crackerbox Draws; maintaining the weir at Buck Springs; rehabilitating 15 structures at Buck Springs and Houston Draw; stabilizing 4 miles of road crossings through improving drainage and installing energy dissipaters on culvert outlets; reshaping 9.5 miles of drainage bottoms where previously obliterated roads have created accelerated erosion; ; raising culverts to create ponded wetlands and installation of energy dissipaters on new culvert arrays at Dick Hart and the 321C road; minimizing impacts to meadows and riparian areas from recreationist at Dines Tank, Dane Springs, 321C, the General Springs Trail and Holder Cabin; the obliteration of 3.8 miles of road, meadow restoration to improve vegetative conditions through 330 acres of thinning encroaching conifers on 330 acres; and paving of 4 sites on the 95/96 roads to minimize sediments. An indirect benefit to soil condition is the risk reduction from stand-replacing fire on at least 19,700 acres through prescribed burning and 9,200 acres of precommercial thinning.

Alternative C best meets this objective by treating larger acres and addressing more soil condition areas. As stated in Alternative B, the largest factor for success in meeting this objective is through getting the proper vegetation re-established on-site after ground disturbance. BMP's are specified for each proposed activity within the Soil and Water specialist report [104]. These are also listed within this document in the mitigation section (Chapter 2, table 4).

Predicted Attainment of Objective #2

Re-introduce fire into the ecosystem. Reduce heavy needle mat in some areas, and replace with a diverse grass, forb, and shrub community.

Alternative A This objective is not expected to be met under this alternative [102].

Alternative B Approximately 10,000 acres of ponderosa pine forests will have burning implemented under this objective. This will successfully obtain this objective on these acres.

Alternative C Approximately 19,700 acres of ponderosa pine forests will be burned under this alternative. Because of this, Alternative C best meets the attainment of this objective within this analysis.

Predicted Attainment of Objective #3

Maintain existing riparian proper functioning conditions (PFC). Improve at-risk and nonfunctional riparian stream reaches to proper functioning condition.

Alternative A This objective will not be met under this alternative [104].

Alternative B The actions to improve channel conditions under this alternative will attain the objectives of moving at-risk and nonfunctional riparian reaches to proper functioning condition. Direct activities that will move nonfunctional reaches towards

proper functioning conditions (PFC) include fixing vertical instability in Buck Springs meadow through fixing old structures; the nonfunctional reach at Dick Hart Draw will be moved toward PFC by removing the tanks in the draw, reshaping the channel and putting in a raised culvert array. The nonfunctional reach at Quien Sabe Draw will be improved through actions to alleviate the connected disturbed area of the road, in this case it is relocate the road and rehab the old road bed that is in the drainage.

Individual stream reaches' proper functioning condition will be improved through vehicle restrictions on the at-risk Upper Yeager at Holder Draw, vehicle restrictions on 321 C will improve the pfc of Bill McClintock Draw and McClintock Draw that are presently at-risk; the at-risk reach at Upper Barbershop Canyon will be improved through removal of tanks; the at-risk Houston Draw reach will be improved through the re-shaping and the fixing of headcuts within the draw; and work at connected disturbed areas at the at-risk Limestone reach will improve conditions at this site. The improvements to all of the reaches listed above will occur over time as site disturbance re-vegetates from the ground disturbance of the restoration activities. As stated above, protective measures stated in BMP's are key to the success of meeting this objective.

Indirect activities that will improve how water moves through the system and in turn maintain or improve pfc throughout the reach include energy dissipaters on open roads, the reshaping of previously obliterated roadbeds in stream courses. Thinning to improve spring flows at Buck, Merritt and Houston Draw will also be an indirect improvement in a favorable water regime.

Alternative C The actions to improve channel conditions under this alternative will attain the objectives of moving at-risk and nonfunctional riparian reaches to proper functioning condition. Direct activities that will move nonfunctional reaches towards PFC include fixing vertical instability in Buck Springs meadow through fixing old structures; thinning in Buck Springs will improve meadow condition thus moving the meadow to PFC, as will obliterating the 9714X road; the nonfunctional reach at Dick Hart Draw will be moved toward PFC by removing the tanks in the draw, reshaping the channel and putting in a raised culvert array. The nonfunctional reach at Quien Sabe Draw will be improved through actions the obliteration of the 9722W road, in this case it is relocate the road and rehab the old road bed that is in the drainage.

Individual stream reaches' proper functioning condition will be improved through vehicle restrictions on the at-risk Upper Yeager at Holder Draw, vehicle restrictions on 321 C will improve the pfc of Bill McClintock Draw and McClintock Draw that are presently at-risk; the Bill McClintock reach will also be improved through the obliteration of the 9737R road; thinning to restore the meadow at Merritt Draw will improve this at-risk reach; The at-risk reach at Upper Barbershop Canyon will be improved through removal of tanks and thinning; the at-risk Houston Draw reach will be improved through the thinning and re-shaping and the fixing of headcuts within the draw; and work at connected disturbed areas at the at-risk Limestone reach will improve the functioning of this reach. The trail relocation at General Springs will also improve the pfc of the at-risk Upper General Springs reach by minimizing potential sediment sources. Thinning in the

meadow at General Springs will also provide a more favorable moisture regime for the meadow that will aid in improving pfc of the Upper General Springs reach. This will occur over time as site disturbance re-vegetates from the ground disturbance of the restoration activities.

Indirect activities that will improve how water moves through the system and in turn maintain or improve pfc throughout the reach include energy dissipaters on open roads, the reshaping of previously obliterated roadbeds in stream courses. Thinning to improve spring flows at Buck, Merritt and Houston Draw will also be an indirect improvement in a favorable water regime. Alternative C will meet this objective better than the other two alternatives through improving more acres of at-risk and functional reaches, as well as improving the water flow regime throughout the entire analysis area.

Predicted Attainment of Objective #4

Increase the extent of wetted areas.

Alternative A This alternative will not meet this objective.

Alternative B All of the projects designed to improve proper functioning condition (PFC) (objective #3) stated above will also improve wetted area. Please see the discussion above for the projects that will assist in attaining this objective.

Alternative C All of the projects designed to improve pfc stated above will also improve wetted area. Please see the discussion above for the projects that will assist in attaining this objective. As with Objective #3, alternative C will do the best job of meeting this objective, both directly and indirectly.

Predicted Attainment of Objective #5

Increase vegetative diversity and total biomass in riparian areas and meadows, with an emphasis on riparian species.

Alternative A This alternative will not meet this objective.

Alternative B Alternative B meets this objective directly through actions proposed to improve vegetative conditions with the raised culverts at Dick Hart Draw and Crackerbox Canyon; the control of the impacts from vehicles at Dane Springs, along the 321C road, and at Holder Cabin. Alternative B meets this action indirectly through improving soil condition which includes the following activities: channel work will minimize erosion potential through laying back of banks (3 miles); stopping headcuts at 12 sites; maintaining the weir at Buck Springs; rehabilitating 15 structures at Buck Springs and Houston Draw; thinning of 100 acres around streams to improve stream flow; stabilizing 3 miles of road crossings through improving drainage and installing energy dissipaters on culvert outlets; reshaping 7 miles of drainage bottoms where previously obliterated roads have created accelerated erosion; thinning around springs

to increase stream flow and paving of 4 sites on the 95/96 roads to minimize sediments. Through these actions, stream energies are decreased and less potential ground-area is lost through advancing headcuts and widening channels. As stated above, re-vegetation of disturbed sites will be key to the successful implementation of this objective.

Alternative C Alternative C meets the objective directly through actions proposed to improve vegetative conditions with the raised culverts at Dick Hart Draw, three crossings along the 321C road and at Holder Cabin that will favor riparian grass species establishment; meadow restoration on 330 acres through thinning of encroaching conifers, the control of vehicular impacts at Dines Tank, Dane Springs, 321C and Holder Cabin, and trail relocation at General Springs.

Alternative C meets this action indirectly through actions designed to minimize sediments which includes the following activities: channel work will minimize erosion potential through laying back of banks (3 miles); stopping headcuts at 12 sites; maintaining the weir at Buck Springs; rehabilitating 15 structures at Buck Springs and Houston Draw; thinning of 100 acres around streams to improve stream flow in meadows; stabilizing 4 miles of road crossings through improving drainage and installing energy dissipaters on culvert outlets; reshaping 9.5 miles of drainage bottoms where previously obliterated roads have created accelerated erosion; the obliteration of 3.8 miles of road; and paving of 4 sites on the 95/96 roads to minimize sediments. Alternative C best meets this objective by treating more sites that will improve greater acreage of vegetation than either Alternative A or B.

Predicted Attainment of Objective #6

Manage use by recreationists that is impeding riparian/meadow recovery.

Alternative A This alternative will not meet this objective.

Alternative B Direct activities that will meet this objective include the road maintenance and pole fence construction at Holder Cabin, and the road maintenance and pole fence construction and directed camping along the 321C road.

Alternative C Direct activities that will meet this objective include the road maintenance and pole fence construction at Holder Cabin, the trail re-location and obliteration of old trail at the General Springs trail, and the road maintenance and pole fence construction and directed camping along the 321C road. Alternative C does attain this objective better than either alternative A or B. The recreation specialists report notes that for successful implementation of recreation access issues will require education, interpretation, and enforcement [103]. Therefore, successful attainment of this objective under either Alternative B or C will be influenced by how much education, on-site interpretation and enforcement is applied to the project areas.

Predicted Attainment of Objective #7

Improve the transportation system to minimize the effects to meadow and riparian areas.

Alternative A This alternative will not meet this objective.

Alternative B There are several actions designed to improve the transportation system to minimize the effects to meadows and riparian areas. Twenty-three particular road interactions within the proposed connected disturbed area work (maintenance on 2 miles, reshaping of channel bottoms on 7 miles of previously obliterated roads) is designed to minimize impacts from the road system to meadows and riparian areas. The remaining other 50 interactions will have an indirect impact through minimized impacts from road crossings on non-riparian systems that will slow water movement throughout the system from roads.

Alternative C Alternative C has the same proposed activities for connected disturbed areas as alternative B, with the addition of the obliteration of three roads (9714X, 9722W, and 9737R roads, respectively). Because of the obliterations, Alternative C will minimize the effects to meadows and riparian better than either alternative A or B. Similar education, interpretation and signing will be necessary to achieve this objective in a fully successful manner.

CHAPTER 4 MONITORING

Some monitoring is required by the Coconino Forest Land Management Plan (CFLMP), as amended; by requirements established through lawsuits and court orders; by conditions of permitting and by reasonable and prudent measures required by Biological Opinions of the US Fish and Wildlife Service.

Required Monitoring

Cultural Resources

- Project administrator must ensure that all ground-disturbing activities receive archeological surveys and clearances prior to implementation.

Wildlife/Aquatic Resources

- Monitoring of habitat conditions and fish populations will continue through the efforts of the Arizona Game and Fish Department and Forest Service personnel. The monitoring of aquatic insect (macroinvertebrate) abundance and species diversity will also occur on sites selected within the watershed.
- In conformance with Regional Direction (Regional Forester, June 2, 1997), inventories of spinedace habitat will continue as a part of the overall management for the species.
- Microhabitat monitoring for Mexican spotted owls will be completed in MSO restricted habitat prior to prescribed burning or thinning projects.
- Survey tanks, channel re-shaping, road crossings on riparian streams scheduled for maintenance and Buck Springs structure maintenance sites for Chiricahua leopard frogs and sensitive riparian insects or plants prior to implementation activities.

Soil and Water

- As a condition of the 404 permit, monitor project specific Best Management Practices for implementation and effectiveness.

CHAPTER 5 LIST OF PREPARERS

NAME	POSITION	INPUT
Core Team Members		
Dick Fleishman:	Watershed Specialist	Team Leader/Soil and Water
Cathy Taylor:	Wildlife Biologist	Wildlife/editor
Jerry Gonzales:	Range Conservationist	Range/editor
Mark Whitney:	Fisheries Biologist	Fisheries
Rogers Steed:	Plans Staff and Forester	Overstory veg/editor
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Liz Blake:	NEPA Specialist	NEPA input/note taker
Katherine Farr:	NEPA Specialist	Reviewer/NEPA input
Trish Callaghan:	District Recreation Staff	Recreation input
Jim Beard:	Landscape Architect	Recreation input
Ed Freed:	Engineering Technician	Roads input
Ed Paul:	Fire Ecologist	Fire/Air/Smoke
Angela Crossley	Archeologist	Cultural Resources
Peter Pilles	Forest Archeologist	Tribal liaison
Debbie Crisp:	Wildlife Technician	Note Taker
Outside Representatives		
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Chuck Benedict:	Az Game and Fish Fisheries Rep.	General Discussions Fisheries Input

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Gila County Commission and Planning
Rocky Mountain F & R Experiment Station
Sun City Sportsment/State EHPP
NAU School of Forestry
U.S. Fish and Wildlife Service
Friends of Arizona Rivers
Southwest Forest Alliance
National Resource Conservation Service
Arizona State Parks
Tonto Natural Resource Conservation District
Central Arizona Guides Association
Rocky Mountain F & R Experiment Station
Flying M Ranch
People for the West
Friends of Arizona Rivers
Bar T Bar Ranch, Inc.
Creepy Crawlers 4 WD Club
Precision Pine and Timber
Conservation Committee, Maricopa Audubon Society
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Canyon State Naturists, Inc.
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Mr. Don Farmer	President Arizona Wildlife Federation
Ms. Anette McGivney	Outdoor Editor Tribune Newspaper
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Mr.Chris Kane	Bodway/Gap Chapter
Mr.Charles Ester	Salt River Project
Mr.Ron McMenimen	M2C2
Ms.Bellispirito	Northern Arizona Grotto
Mr.Green	Cochise County Cavers
Mr. Bednorz	Mule Mountain Caving Club
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Mr. Ron Woolwine	Payson Maintenance Arizona Department of Transportation
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Mr. Dave Walker	President Arizona Chapter, Wildlife Society
Mr. Veldon Lee President	Clear Creek Pines Property Owners Association - Units 8 and 9
Mr. Joseph C. Hull	Science Advisory Committee Trout Unlimited
Mr. Brian Segee	Appeal Coordinator Southwest Center for Biological Diversity
Mr. Charles Lane	Director of Grower Affairs Arizona Cattlegrowers

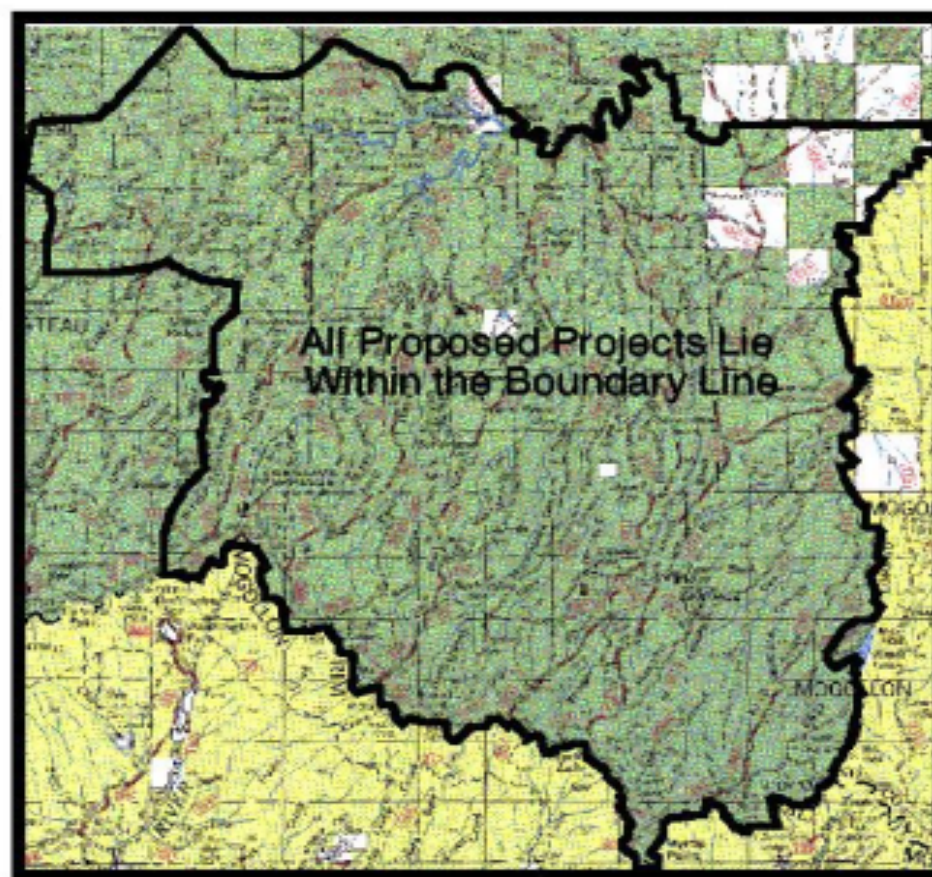
ORGANIZATIONS CONTACTED

American Rivers' Southwest Regional Office
Friends of the Prescott National Forest
Clear Creek Pines - Units 4,5,6; Protective Association Inc.
Northern Arizona Audubon Society
International Llama Association, Trails Action Team

CHAPTER 7 APPENDICES

- Appendix A: Vicinity Map**
- Appendix B: Alternative B-- Proposed Action Map**
- Appendix C: Connected Disturbed Area Road List**
- Appendix D: Alternative C—Preferred Alternative Map**
- Appendix E: Location/Sites for Precommercial thinning in Alternative C**
- Appendix F: Map of Life Zones and Soil Condition**
- Appendix G: Relative Costs**
- Appendix H: Response to Comments**

VICINITY MAP EAST CLEAR CREEK WATERSHED HEALTH ENVIRONMENTAL ASSESSMENT

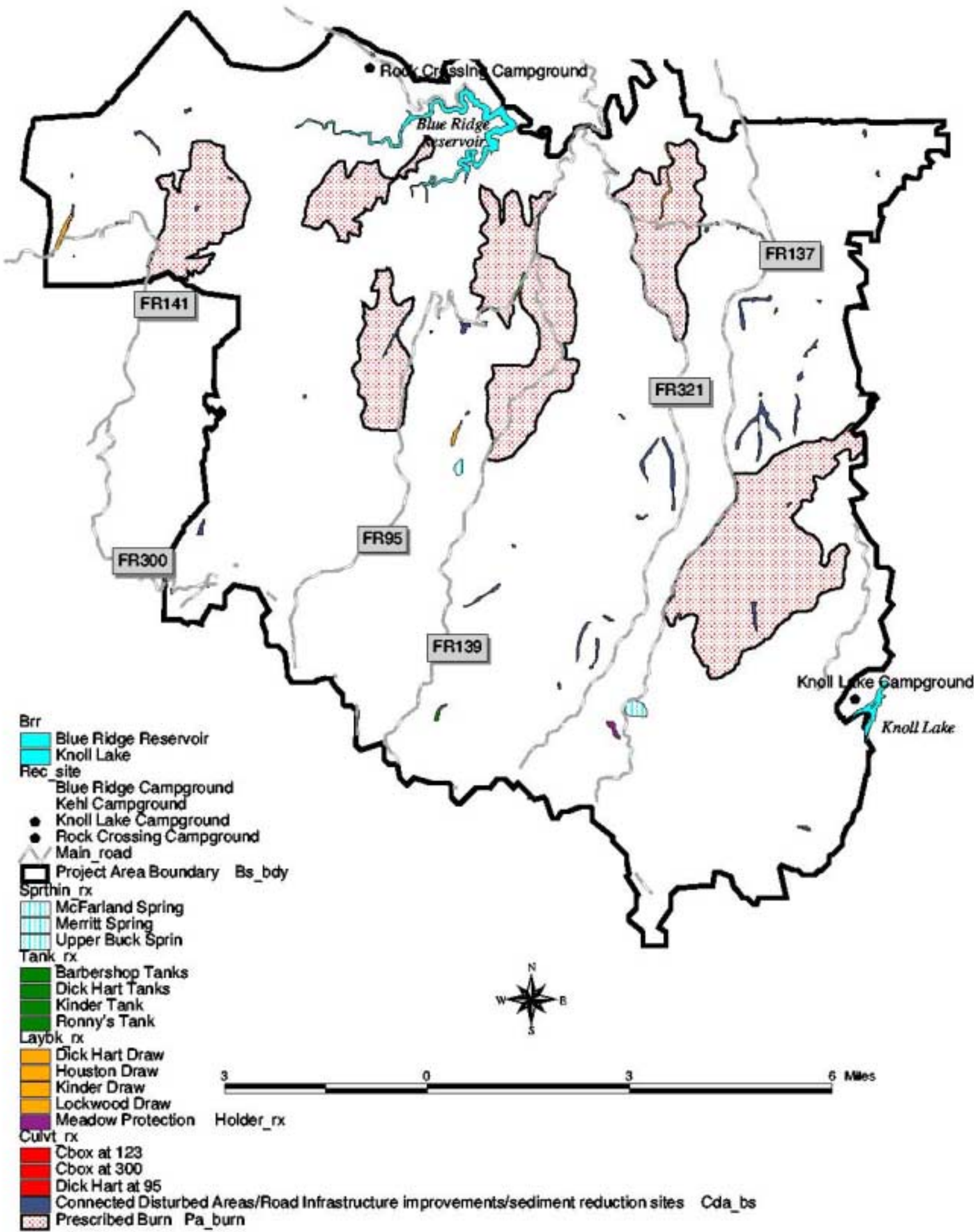


Appendix B

Alternative B-Proposed Action

East Clear Creek Watershed Health Project

Coconino National Forest



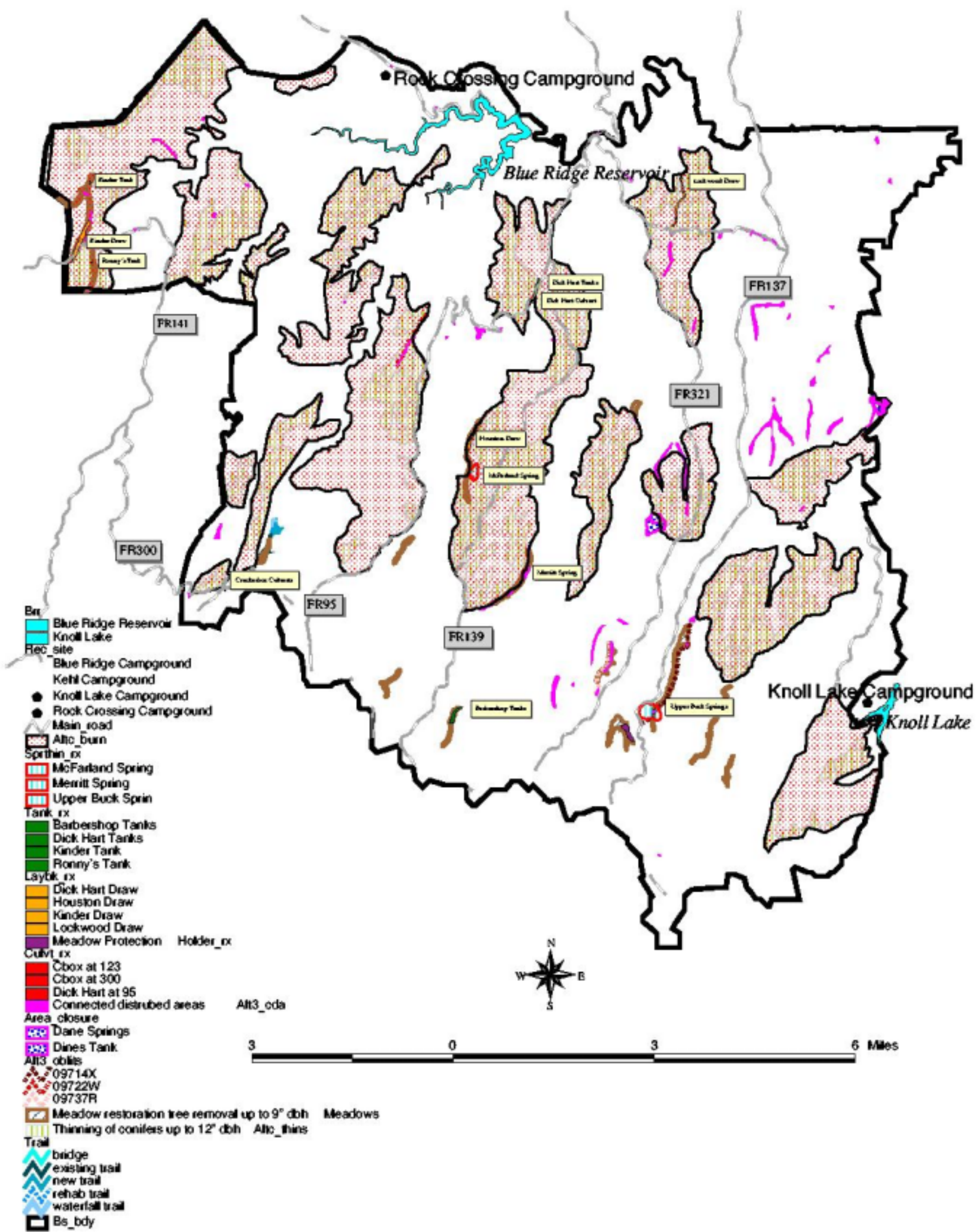
Roads to be Treated in Alternatives B and C					
	Road				
CDA	number	RX		CDA	Road
				number	RX
808A004	95	PAVE		808D511	009616A MAINTENANCE
808A006	95	PAVE		808B520	009707A MAINTENANCE
808E006	95	RAISE CULVERT		808BLIME	009707E RESHAPE
808E517	95	MAINTENANCE		808D012	009707R RESHAPE
808A505	96	MAINTENANCE		808A504	009707W RESHAPE
808C506	96	MAINTENANCE		808A506	009707X RESHAPE
808C508	96	MAINTENANCE		808D513	009707Y RESHAPE
808D001	96	PAVE		808E512	009709K RESHAPE
808D525	96	MAINTENANCE		808B003	009711P RESHAPE
808G004	141	MAINTENANCE		808B543	009712T MAINTENANCE
808G538A	141	MAINTENANCE		808B544	009712U MAINT. & RESHAPE
808G541	141	MAINTENANCE		808B005	009713K RESHAPE
808B007	161	MAINTENANCE		808B005A	009713K RESHAPE
808B003	298	MAINTENANCE AND		808B521	009713L RESHAPE
		CLOSE LAST 0.4 MILES		808B530	009714X RESHAPE
808F015A	300	MAINTENANCE		808B531	009714X RESHAPE
808B004	600	MAINTENANCE		808E008	009722W RELOCATE & RESHAPE
808G538	701	MAINTENANCE		808C508	009723Y RESHAPE
808G530	751	MAINTENANCE		808A500	009729W MAINTENANCE
808G531	751	MAINTENANCE		808B529	009734T MAINTENANCE
808G532	751	MAINTENANCE		808D004	009735P RESHAPE
808E014	000095B	MAINTAIN TRAIL		808D004A	009735P RESHAPE
808B518	000137D	RESHAPE		808D004B	009735P RESHAPE
808G536	000141A	MAINTENANCE		808D010	009737R RESHAPE
808G529	000141B	MAINTENANCE		808D013	009737R RESHAPE
808F015	000141H	RAISE CULVERT		808E016	009738N MAINTENANCE
808D009	000321C	MAINTENANCE		COYOTE	MEADOW RESHAPE
808D020	000321C	MAINTENANCE			
808321C	000321C	MAINTENANCE			
808B533	000600A	RESHAPE			
808G538B	000612C	MAINTENANCE			
808C004	000643A	MAINTENANCE AND			
		RELOCATE			
808G535	006033C	MAINTENANCE			
808G539	006033C	MAINTENANCE			
808E521	009030N	MAINTENANCE			
808E515	009030S	MAINTENANCE			
808F505	009031G	MAINTENANCE			
808F014	009031J	MAINTENANCE			
808B534	009615G	RESHAPE			
808B525	009615K	RESHAPE			

Appendix D

Alternative C-Preferred Alternative

East Clear Creek Watershed Health Project

Coconino National Forest



Location	Site	Acres
757	7	53
	9	16
	24	69
	25	16
	27	111
	29	29
	30	13
	31	16
	32	12
	34	27
	39	8
	40	43
	42	49
	43	43
	44	41
759	3	97
	6	52
	10	4
	15	29
	16	35
	17	81
	22	42
760	15	7
	18	108
	19	5
761	2	94
	3	141
	5	102
	11	74
	13	23
	16	18
762	9	31
	10	44
	11	18
763	3	50
	5	16
	7	20
	12	4
	19	66
	21	29
	22	3
	23	3
	30	4
	32	9
	41	8
	44	73

Location	Site	Acres
764	2	23
	5	13
	6	31
	8	8
	10	16
	11	16
	13	26
	15	22
	19	54
	20	17
	22	26
	24	77
	42	67
	43	13
	44	12
765	1	89
	9	41
	10	35
	22	3
766	4	53
	10	6
	20	68
	36	4
	47	9
767	10	33
	12	156
	17	57
769	9	14
	10	2
	12	7
	15	7
	17	9
	18	9
	19	4
770	2	41
771	5	228
	8	148
	11	22
	12	49
	16	124
	17	55
	18	48
	19	6
772	11	32
	13	14
	14	8

Location	Site	Acres
773	11	184
	13	8
	14	28
	29	54
	30	21
	31	14
	32	9
	33	37
774	1	13
	2	51
	4	45
	6	92
	7	28
	20	10
	21	5
	22	47
	24	13
	25	2
775	2	48
	4	78
	5	63
	6	67
	9	42
	10	29
	11	111
	12	88
	13	34
	16	86
	17	48
	18	27
	20	66
	21	4
	22	79
	32	78
	35	8
	36	16
	38	18
	39	20
	43	7
	45	21

*Chapter 7 Appendix E—Table of Location/Sites to be precommercial thinned in Alternative C
East Clear Creek Watershed Health Environmental Assessment*

Location	Site	Acres
776	6	18
	22	12
	24	7
	26	4
	27	8
	28	9
	30	39
	32	18
777	6	117
	12	1
	16	65
	18	121
780	9	7
	10	18
	18	41
	20	44
	21	79
	23	15
	24	36
	26	48
	27	7
	28	11
	30	11
	35	9
	36	18
	37	26
	38	17
	39	35
	40	43
	45	33
	46	17
	69	24
	72	23
782	1	14
	3	13
	6	31
	16	2
	40	6
783	9	7
	12	32
	14	26
	17	32
	26	20
	27	23
	29	42
	30	77
	33	7
	34	16

Location	Site	Acres
783	35	29
	36	25
	41	11
	44	4
	45	3
	57	2
	61	18
	62	70
	63	4
784	2	44
	5	7
	7	10
	9	37
	10	16
	12	15
	20	39
785	15	24
	16	28
	17	10
	18	47
	21	45
	22	32
	23	14
	28	22
	29	9
	30	16
	35	7
	37	3
	38	10
	39	6
	43	3
	44	9
	55	29
	56	26
	57	14
	58	25
	60	3
791	4	72
	9	9
	10	27
	11	4
793	17	17
	32	9
	8	19
	29	18
	30	19
	31	15
	33	73

Location	Site	Acres
793	34	23
795	1	42
	2	5
	3	41
	4	80
	16	4
	19	29
	20	20
	21	30
	23	77
	24	20
	27	2
	30	14
	31	59
	35	35
796	2	48
	3	9
	4	27
	5	49
	6	12
	7	11
	8	101
	9	40
	13	35
	16	26
	17	88
	18	59
	20	0
	21	59
	22	46
	23	14
	24	26
	25	5
	26	22
	27	40
	28	23
	29	8
	30	5
	31	13
798	21	17
	22	29
	26	23
	27	8
	29	3
	31	71
	61	144
	67	2
	68	4

Appendix F

Life Zones and Soil Condition

East Clear Creek Watershed Health Project

Coconino National Forest

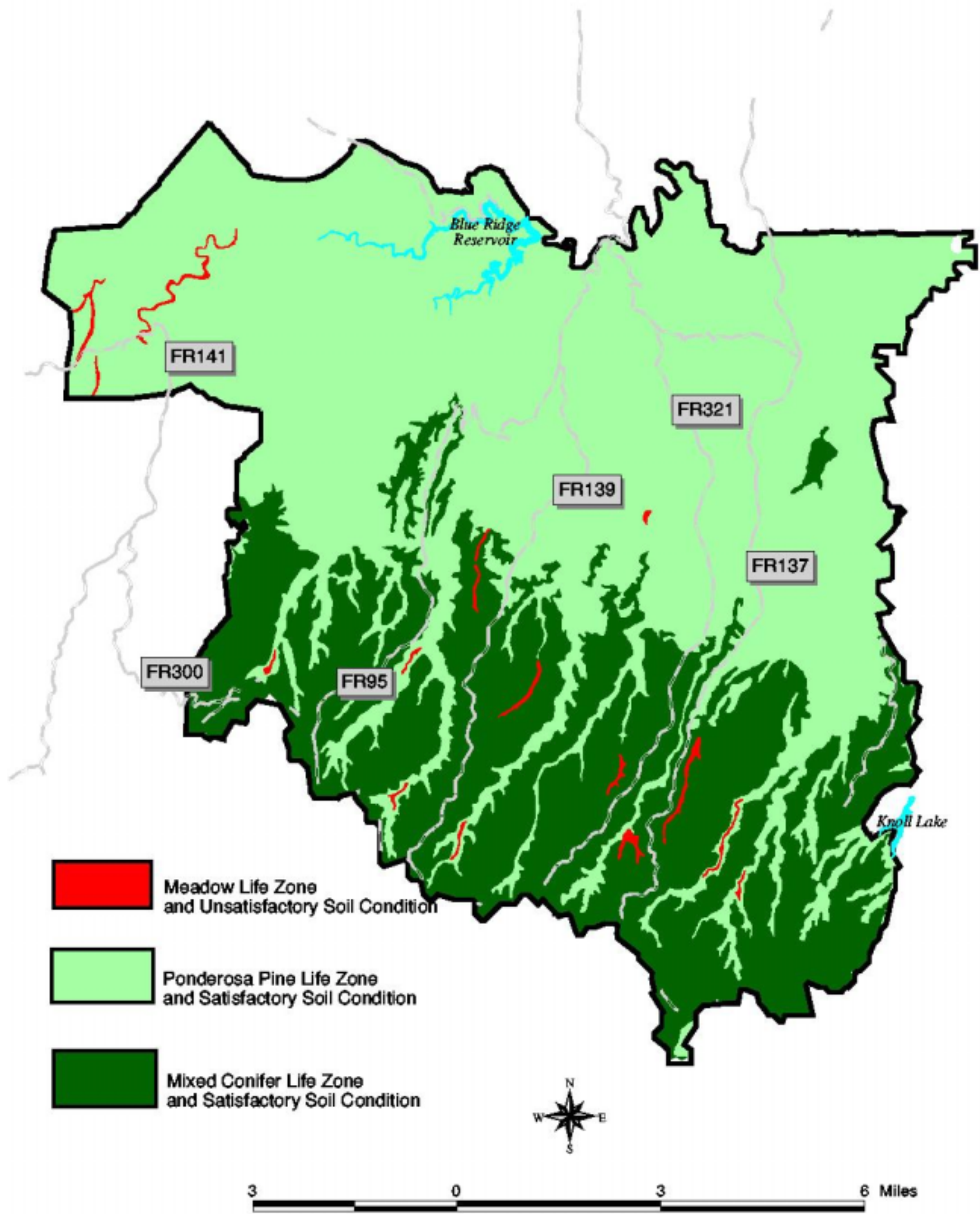


Table 9: Relative Costs of Treatments for Alternatives B and C

Alternative B List of				PNV Cost	PNV Cost
Treatments	Unit	Alt B	Cost	@ 4%	@ 7%
Prescribed burning	acres	10,000	\$500,000	\$405,545	\$351,179
Remove tanks and rehabilitate site @ Barbershop/Dick Hart	sites	5	\$30,000	\$23,856	\$20,358
Install headcut drop structures(Gen Springs,Houston,Lockwood)	sites	12	\$24,000	\$21,336	\$19,591
layback banks/hydromulch Houston,Lockwood,Kinder,Dick Hart	miles	3	\$180,000	\$143,455	\$122,968
raise culverts to create ponded wetlands Dick Hart/Crackerbox	sites	3	\$80,000	\$68,437	\$61,171
rehabilitate or remove structures Buck Springs	sites	15	\$7,500	\$6,411	\$5,722
maintain weir at Buck Springs	sites	1	\$3,500	\$3,236	\$3,057
miles of previously obliterated rds restored	miles	7	\$54,500	\$46,726	\$41,956
stabilize stream crossings	miles	2	\$39,000	\$31,632	\$27,392
install pole fence along 321C at meadow sections	miles	1.2	\$20,000	\$16,439	\$14,260
relocate 643A road and rehabilitate rd in Holder Cabin meadow	miles	0.5	\$10,000	\$7,903	\$6,663
convert closed road at Dane Springs	miles	0.5	\$2,000	\$1,849	\$1,747
pave locations on 95/96 roads	miles	0.3	\$25,000	\$22,847	\$21,407
thin trees at springs (McFarland, Houston, and Buck)	acres	100	\$45,000	\$34,354	\$28,410
Total Cost			\$1,020,500	\$834,026	\$725,881

Alternative C List of				PNV Cost	PNV Costs
Treatments	Unit	Alt C	Cost	@ 4%	@ 7%
Prescribed burning	acres	19,700	\$985,000	\$798,923	\$691,823
Precommercial thinning	acres	9,200	\$940,000	\$762,424	\$660,217
Remove tanks and rehabilitate site @ Barbershop/Dick Hart	sites	7	\$42,000	\$36,012	\$32,336
natural channel design (Houston,Lockwood)	sites	11	\$55,000	\$44,648	\$41,157
Install headcut drop structures(Gen Springs)	sites	1	\$2,000	\$1,778	\$1,633
layback banks/hydromulch Houston,Lockwood,Kinder,Dick Hart	miles	3	\$180,000	\$143,445	\$122,968
raise culverts to create ponded wetlands Dick Hart and 321C	sites	4	\$160,000	\$139,557	\$126,475
rehabilitate or remove structures Buck Springs	sites	15	\$7,500	\$6,411	\$5,722
maintain weir at Buck Springs	sites	1	\$3,500	\$3,236	\$3,057
miles of previously obliterated rds restored	miles	7	\$67,500	\$52,469	\$45,693
stabilize stream crossings	miles	2	\$52,500	\$42,582	\$36,874
install pole fence along 321C at meadow sections	miles	1.2	\$20,000	\$16,439	\$14,260
relocate 643A road w semi-permeable road	miles	0.25	\$50,000	\$39,516	\$33,317
area closure & convert closed road at Dane Springs	miles	0.5	\$2,000	\$1,849	\$1,747
area closure,fence trail conversion Dines Tank	miles	0.2	\$10,000	\$9,615	\$9,346
pave locations on 95/96 roads	miles	0.3	\$25,000	\$22,847	\$21,407
thin trees at springs (McFarland, Houston, and Buck)	acres	100	\$45,000	\$34,354	\$28,410
obliterate rds 9714X,9722W and 9737R	miles	3.8	\$25,600	\$21,241	\$18,559
re-route trail/rehab/bridge at General Springs	miles	0.39	\$28,000	\$23,935	\$21,361
meadow restoration through thinning	acres	330	\$6,000	\$5,041	\$4,455
Total			\$2,706,600	\$2,206,322	\$1,920,817

Table 10: Cost Stream and Implementation Assumptions Made for Alternatives B and C at 4% and 7% interest

Alternative B @ 4% interest	yr 1	yr 2	yr 3	yr 4	yr 5	yr 6	yr 7	yr 8	yr 9	yr 10	Total PNV
assume 1000 ac burned/year	\$48,077	\$46,228	\$44,450	\$42,740	\$41,096	\$39,516	\$37,996	\$36,535	\$35,129	\$33,778	\$405,545
assume 1 tank is removed every 2 years		\$5,547		\$5,129		\$4,742		\$4,384		\$4,053	\$23,856
assume drop structures are completed in year 3			\$21,336								\$21,336
assume 1 mile of layback banks is completed every 3 years	\$19,231	\$18,491	\$17,780			\$47,419				\$40,534	\$143,455
assume culverts raising occurs in year 3(1cul) and year 5 (1 cul)			\$35,560		\$32,877						\$68,437
assume structure rehabilitation is completed in year 4				\$6,411							\$6,411
maintain weir in year 2		\$3,236									\$3,236
assume 1 mile of road rehabed per year	\$7,486	\$7,198	\$6,921	\$6,655	\$6,399	\$6,153	\$5,916				\$46,726
Assume 0.2 mile/yr is stabilized	\$3,750	\$3,606	\$3,467	\$3,334	\$3,206	\$3,082	\$2,964	\$2,850	\$2,740	\$2,635	\$31,632
assume pole fence on 321C is completed in year 5					\$16,439						\$16,439
assume holder cabin work is completed in year 6						\$7,903					\$7,903
assume convert Dane Springs road is done in year 2		\$1,849									\$1,849
assume pave is completed in year 2 and 3		\$16,180	\$6,667								\$22,847
assume thin trees is completed in year 4,7, and 10.				\$12,822			\$11,399			\$10,133	\$34,354
totals	\$78,543	\$102,335	\$136,181	\$77,091	\$100,016	\$108,814	\$58,274	\$43,768	\$37,869	\$91,134	\$834,026

Alternative B @ 7% interest	yr 1	yr 2	yr 3	yr 4	yr 5	yr 6	yr 7	yr 8	yr 9	yr 10	Total PNV
assume 1000 ac burned/year	\$46,729	\$43,672	\$40,815	\$38,145	\$35,649	\$33,317	\$31,137	\$29,100	\$27,197	\$25,417	\$351,179
assume 1 tank is removed every 2 years		\$5,241		\$4,577		\$3,998		\$3,492		\$3,050	\$20,358
assume drop structures are completed in year 3			\$19,591								\$19,591
assume 1 mile of layback banks is completed every 3 years	\$18,692	\$17,469	\$16,326			\$39,981				\$30,501	\$122,968
assume culverts raising occurs in year 3(1cul) and year 5 (1 cul)			\$32,652		\$28,519						\$61,171
assume structure rehabilitation is completed in year 4				\$5,722							\$5,722
maintain weir in year 2		\$3,057									\$3,057
assume 1 mile of road rehabed per year	\$7,276	\$6,800	\$6,355	\$5,939	\$5,551	\$5,187	\$4,848				\$41,956
assume 0.2 mile/yr is stabilized	\$3,645	\$3,406	\$3,184	\$2,975	\$2,781	\$2,599	\$2,429	\$2,270	\$2,121	\$1,983	\$27,392
assume pole fence on 321C is completed in year 5					\$14,260						\$14,260
assume holder cabin work is completed in year 6						\$6,663					\$6,663
assume convert Dane Springs road is done in year 2		\$1,747									\$1,747
assume pave is completed in year 2 and 3		\$15,285	\$6,122								\$21,407
assume thin trees is completed in year 4,7, and 10.				\$11,443			\$9,341			\$7,625	\$28,410
totals	\$76,341	\$96,677	\$125,045	\$68,802	\$86,760	\$91,745	\$47,756	\$34,862	\$29,318	\$68,576	\$725,881

Chapter 7 Appendix G—Relative Costs
East Clear Creek Watershed Health Environmental Assessment

Alternative C @ 4% interest	yr 1	yr 2	yr 3	yr 4	yr 5	yr 6	yr 7	yr 8	yr 9	yr 10	TOTAL
assume 1970 ac burned/year	\$94,712	\$91,069	\$87,566	\$84,198	\$80,960	\$77,846	\$74,852	\$71,973	\$69,205	\$66,543	\$798,923
assume 940 acres is thinned/year	\$90,385	\$86,908	\$83,566	\$80,352	\$77,261	\$74,290	\$71,432	\$68,685	\$66,043	\$63,503	\$762,424
assume 1 tank is removed every year	\$5,769	\$5,547	\$5,334	\$5,129	\$4,932	\$4,742	\$4,560				\$36,012
assume 4 sites at year 2, and 3 sites at year 3 and 4		\$18,491	\$13,335	\$12,822							\$44,648
assume drop structure are completed in year 3			\$1,778								\$1,778
assume 1 mile of layback banks is completed every 3 years	\$19,231	\$18,491	\$17,780			\$47,419				\$40,534	\$143,455
assume culverts raising occurs in year 3(3cul) and year 5 (1 cul)			\$106,680		\$32,877						\$139,557
assume structure rehabilitation is completed in year 4				\$6,411							\$6,411
maintain weir in year 2		\$3,236									\$3,236
assume 1 mile of road rehabed per year, 0.5 miles last year	\$6,490	\$6,241	\$6,001	\$5,770	\$5,548	\$5,335	\$5,129	\$4,932	\$4,742	\$2,280	\$52,469
assume .39 mile/yr is stabilized	\$5,048	\$4,854	\$4,667	\$4,488	\$4,315	\$4,149	\$3,990	\$3,836	\$3,689	\$3,547	\$42,582
assume pole fence on 321C is completed in year 5					\$16,439						\$16,439
assume holder cabin work is completed in year 6						\$39,516					\$39,516
assume convert Dane Springs road is done in year 2		\$1,849									\$1,849
assume convert Dines Tank closure/fence/trail in year 1	\$9,615										\$9,615
assume general springs trail work done in year 4				\$23,935							\$23,935
assume road oblit in year 3,4, 5			\$1,778	\$1,710	\$17,754						\$21,241
assume meadows thinned in years 2,3,4,5,6, and 7 (50ac/yr)		\$925	\$889	\$855	\$822	\$790	\$760				\$5,041
assume pave is completed in year 2 and 3		\$16,180	\$6,667								\$22,847
assume thin trees is completed in year 4,7, and 10.				\$12,822			\$11,399			\$10,133	\$34,354
totals	\$231,250	\$253,791	\$336,041	\$238,490	\$240,907	\$254,086	\$172,121	\$149,426	\$143,679	\$186,540	\$2,206,331

Chapter 7 Appendix G—Relative Costs
East Clear Creek Watershed Health Environmental Assessment

Alternative C @ 7% interest	yr 1	yr 2	yr 3	yr 4	yr 5	yr 6	yr 7	yr 8	yr 9	yr 10	TOTAL
assume 1970 ac burned/year	\$92,056	\$86,034	\$80,405	\$75,145	\$70,229	\$65,635	\$61,341	\$57,328	\$53,577	\$50,072	\$691,823
assume 940 acres is thinned/year	\$87,850	\$82,103	\$76,732	\$71,712	\$67,021	\$62,636	\$58,538	\$54,709	\$51,130	\$47,785	\$660,217
assume 1 tank is removed every year	\$5,607	\$5,241	\$4,898	\$4,577	\$4,278	\$3,998	\$3,736				\$32,336
assume 4 sites at year 2, and 3 sites at year 3 and 4		\$17,469	\$12,244	\$11,443							\$41,157
assume drop structure are completed in year 3			\$1,633								\$1,633
assume 1 mile of layback banks is completed every 3 years	\$18,692	\$17,469	\$16,326			\$39,981				\$30,501	\$122,968
assume culverts raising occurs in year 3(3cul) and year 5 (1 cul)			\$97,956		\$28,519						\$126,475
assume structure rehabilitation is completed in year 4				\$5,722							\$5,722
maintain weir in year 2		\$3,057									\$3,057
assume 1 mile of road rehabed per year, 0.5 miles last year	\$6,308	\$5,896	\$5,510	\$5,150	\$4,813	\$4,498	\$4,204	\$3,929	\$3,672	\$1,716	\$45,693
Assume 0.39 mile/yr is stabilized	\$4,907	\$4,586	\$4,286	\$4,005	\$3,743	\$3,498	\$3,269	\$3,056	\$2,856	\$2,669	\$36,874
assume pole fence on 321C is completed in year 5					\$14,260						\$14,260
assume holder cabin work is completed in year 6						\$33,317					\$33,317
assume convert Dane Springs road is done in year 2		\$1,747									\$1,747
assume convert Dines Tank closure/fence/trail in year 1	\$9,346										\$9,346
assume general springs trail work done in year 4				\$21,361							\$21,361
assume road oblit in year 3,4, 5			\$1,633	\$1,526	\$15,401						\$18,559
assume meadows thinned in years 2,3,4,5,6, and 7 (50ac/yr)		\$873	\$816	\$763	\$713	\$666	\$623				\$4,455
assume pave is completed in year 2 and 3		\$15,285	\$6,122								\$21,407
assume thin trees is completed in year 4,7, and 10.				\$11,443			\$9,341			\$7,625	\$28,410
totals	\$224,766	\$239,759	\$308,561	\$212,848	\$208,976	\$214,229	\$141,053	\$119,021	\$111,234	\$140,368	\$1,920,815

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